

SOCIAL ASPECTS OF THE BUSINESS CYCLE

BY
DOROTHY SWAINE THOMAS
PH.D. (ECON.)

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THERE is no pretence of originality in the economic argument presented in Chapter I—its relation to Professor Wesley C. Mitchell's analysis is obvious.

My indebtedness to two of my teachers, Professor William F. Ogburn, of Columbia University, and Professor Arthur L. Bowley, of the London School of Economics, is greater than I can adequately acknowledge. I am appreciative not only for much help on specific points, but even more because their own work represents an ideal in the application of scientific methods in the social sciences towards which this book purports to be a slight contribution.

D S THOMAS.

INTRODUCTION

THE object of this study is an examination of the sociological aspects of the business cycle. The tool is statistical analysis. The results will be expressed quantitatively, and the interpretations limited by the exigencies of quantitative analysis. The general problem is to discover in what spheres of social activity the business cycle shows its influence, and to measure the relative degree of this influence in each of the fields considered.

It is only within the last few decades that the economic aspects of business cycles have been given quantitative expression, and the discussion of the social aspects is still largely in the state of unproved hypothesis. The sociologist is handicapped in his efforts to apply true laboratory methods to his investigations—the substitution of the “cruder gauge afforded by statistics”¹ does not always give clear-cut results. For, as Longstaff pointed out,² “Social and political phenomena rarely allow themselves to be fitted into the rigid figures of the logician, but rather resemble indeterminate equations with many unknown quantities, and reasoning applied to such

¹ Wesley C. Mitchell *Business Cycles*, Univ. of California Studies, Berkeley, 1913, p. 20.

² G. B. Longstaff *Studies in Statistics*, London, 1891, p. 1

phenomena takes the modified form of probable reasoning. But although the *data* of sociology are not definite enough for exact mathematical treatment, they are often sufficient to admit of such an application of the numerical method as will yield a first approximation to a solution." What was true in 1891 in regard to the limitations of sociological investigation is still, to a large extent, true in 1924. Now, however, there is available a large body of facts regarding economic and social phenomena which had not been brought to light in 1891—and statistical methods have been developed which make it possible to estimate probable relationships more closely. The estimate must still be inconclusive, because of the imperfections existing both in statistics and in methods. It is to be hoped that the sociologist of fifty years hence will have at his disposal statistical records so complete and accurate, and methods so refined that he may evolve a really conclusive estimate of the social influences of the business cycle. Meantime, the collection and analysis of existing data cannot be considered wasted effort.

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THE PROBLEM AND ITS SETTING

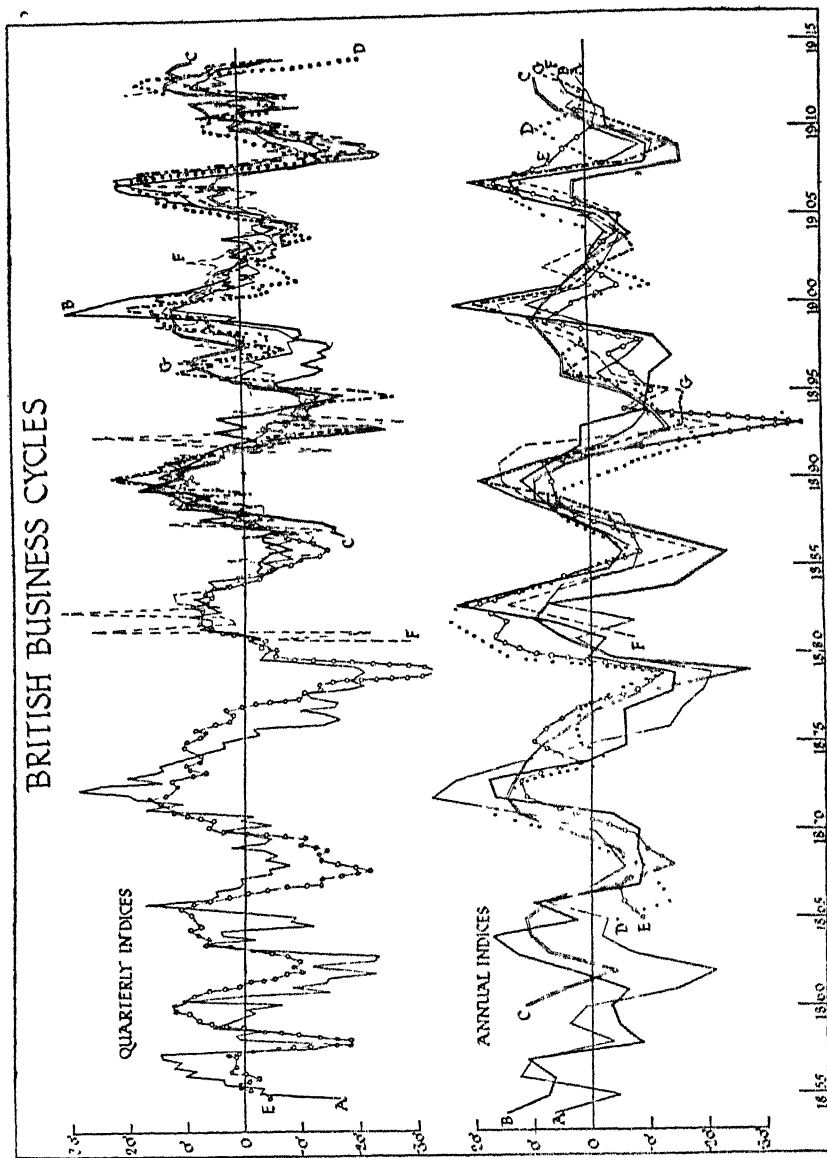


CHART I.

See page 12 for explanation.

CHAPTER I

THE PROBLEM AND ITS SETTING

CHANGE is a fundamental aspect of the present economic system. New inventions, technological developments, and the opening up of great natural resources have given an upward swing to production—a tendency which has seemed to increase cumulatively. Along with this increase in production have come great changes in income, and movements in wages which have caused a parallel increase in consumption. The price-level has been subject to vast perturbations. Practically every phase of economic life has felt the force of these great general movements. In addition to these long-time movements and general trends there has been a constant ebb and flow of economic life. Industry has been subjected to cycles of prosperity and depression—great wave movements with three to eleven years from crest to crest and which vary widely in intensity and depth. The concept of “normality” in regard to economic life is a situation of flux and reflux. Industry is continually merging from one phase of the business cycle to another. Conditions favourable to expansion grow out of a depression—activity, once started, tends to culminate in a “boom”. The boom itself ultimately precipitates a crisis—

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and from the crisis there tends to be a slow receding to the trough of the depression, from which favourable circumstances once more generate an incipient state of activity, and the cycle repeats itself. Generally speaking, any business cycle passes through the phases outlined above, but every cycle exhibits individual peculiarities. Statistical analyses of characteristic cycles have shown, however, that the similarities between cycles are much greater than their differences. The description of business cycles which follows is based almost entirely on the analysis developed by Professor Wesley Mitchell in his investigation of business cycles in the United States, England, France, and Germany from 1890-1911¹

Mitchell has shown that in a state of incipient activity, following a depression, the level of prices is low as compared with full prosperity, and therefore costs of production are low. There are liberal bank reserves and low rates of interest, conditions favourable to loans. A revival in some branch of business, under these conditions, is almost inevitable, and, because of the close interrelations of the business world, a revival, once started, tends to spread and become cumulative in its effects. As the physical expansion of business increases, prices are raised—but at a differential rate as between wholesale and retail, finished and partly manufactured products,

¹ Op. cit.

consumers' and producers' goods, etc. This, combined with the lag in the rise of wages, gives a differential advantage to some business enterprises and makes possible wide margins of profit. But it also tends to injure other businesses and sows the seeds of future difficulties. As full prosperity emerges the supplementary costs of doing business increase disproportionately to the rise in selling prices. Wages rise, there is full employment, and the efficiency of labour tends to decline. Weak enterprises which were forced to close down in depression enter competition in prosperity. They are wasteful, and work on a low margin of profit—their resumption of business bids up prices—and their output increases the difficulty of advancing selling prices to cover advanced costs. Contracts are renewed at high rates of interest. Eventually, a scarcity of funds, due to the great demand for loans and the large amounts of money required for circulation, etc., causes a tension in the investment and money markets, and a consequent rise of interest rates encroaches still further upon profits. This stringency affects particularly the manufacturers of producers' goods who have been stimulated especially during prosperity, and who now find increasing costs of doing business and a lessening demand for their products.

These various stresses become serious when the selling price cannot be raised high enough to prevent

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serious encroachments on profits for some important business enterprises which are eventually forced into liquidation. Prosperity is usually in full swing for the greater part of the business world when the crisis occurs, for the system of credit is so inter-related that a few serious liquidations may cause widespread disaster. If the banking system is inadequate to meet this strain a financial panic may result. Otherwise, the crisis merges into a state of depression. Producers' demand falls off, there is widespread discharge of labourers and a consequent decrease in consumers' demand. Investors' demand for construction work decreases even more rapidly. The level of prices falls rapidly as the physical volume of trade contracts. But this fall of prices is not uniform, and again gives a differential advantage to certain lines. Although the depression spreads and becomes cumulative just as prosperity did, yet processes evolve which tend to bring it to an end. The costs of doing business are greatly reduced—funds are plentiful, rates of interest low, labour is cheap and more efficient, accumulated stocks are got rid of, and demand for fresh stocks is revived. These forces set the physical volume of trade expanding—a few businesses become prosperous, and unless there is some sudden check, a real revival of activity sets in. Thus, the recurring periods of prosperity and depression, which are phenomena of modern industry, tend to cause a continual state of

flux and reflux in the economic life. A general description¹ of this change from phase to phase as it manifests itself in the industrial sphere from 1854-1913 follows, and the later chapters deal with the so-called "repercussions" of these economic forces upon the social life.

The first year in the period under consideration—1854—followed several years of exceptional activity, especially notable for the unprecedented boom in exports. The year opened with promise—and the generally prosperous conditions of industry were accentuated by an exceptionally good harvest. In 1855, although the general prosperity still prevailed, there was a slump in several trades, and a sharp decline in export demand, due to the bad conditions in Australia and the United States. There was a complete recovery in 1856, and a sudden and remarkable expansion of exports, coincident with the revival of the Australian and American markets. The year was held to be one of "the most profitable in almost every branch of trade that has been experienced for some years past" in spite of which "there was never a more severe crisis" than in 1857. The crisis was of foreign rather than domestic origin, and industry as a whole seemed to recover before the end of the year. The recovery was continued

¹ These descriptions are based largely on the annual summaries published in *The Economist*. Reference is also made occasionally to Mitchell's book, op. cit., and to the summaries published in the *Harvard Review of Economic Statistics*.

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throughout 1858, and in 1859 domestic trade was "sound, good, and increasing", but the export trade continued dull. The depression, following upon the crisis of 1857, did not set in until 1860-1, in which years low prices and unemployment persisted. 1862 was a year of recovery—and business conditions as a whole were stable. The ruin of the cotton industry (due to American conditions) had little effect upon general trade. 1863 and 1864 were years of great activity and prosperity for merchants and manufacturers, and culminated in a boom which began late in 1864 and extended throughout 1865, when the end of the Civil War in America brought stability to the cotton market and increased the general export demand. 1866 was a year of "almost uniform disaster". There was a cattle plague, exceptionally bad weather, deficient harvests, and political disturbances at home and abroad. There were great financial difficulties culminating in the failure of the Overend Gurney Company. The crisis was immediately followed by a depression, with a great reduction in wholesale prices and in wages, and widespread unemployment. The depression showed its effects particularly in the money market, by a lack of confidence and inhibition of investment. The lowest point in the depression was reached in 1867, a year of continued liquidation, falling prices and wages. In 1868 conditions began to improve and by 1869 there was genuine activity in many

trades. Wages, however, continued to be depressed until the end of the year. The good start made in 1869 was checked in 1870 by the effects of the war on the Continent, resulting in great losses in foreign investment. 1871 was a year of activity and of vigorous promotion of new companies. Prices and wages rose steadily in 1872, and the boom was continued in spite of a deficient harvest and a cattle plague. There was a severe reaction in the last quarter of 1873, aggravated by the disasters of the American railways, but domestic steadiness prevented the development of a severe crisis. During 1874 prices continued to fall, and there were serious labour troubles. A depression was thoroughly developed by 1875, with great unemployment in the leading trades. The bad harvests of 1875 and 1876 accentuated the depression. The famine in India, uncertainty in foreign affairs, a cattle plague, and deep depression in the iron industry inhibited a recovery in 1877. Prices remained low throughout 1878, which was, for many trades, the trough of the depression. The general failure of European crops in 1879 prolonged the depression, but there was a revival in export demand due to heavy American buying in the last quarter of the year. The iron, steel, and shipping trades made a good recovery, but the boom was checked by the depression in America. Business remained dull until 1886 when the boom in America gave a strong impetus to revival.

The great American railway boom stimulated the coal, iron, and shipping trades, and prosperity became general. These were years of tremendous speculation and the promotion of new companies. The expansion was brought sharply to an end by the financial crisis of 1890 when the stringent money market and political uncertainty in the Argentine brought about the failure of Baring Brothers. A panic was averted by the prompt action of the Bank of England, but widespread liquidation followed. There was a distinct falling off of domestic and foreign trade, and a prevalence of unemployment and low prices in 1892—conditions which were made worse by a deficient harvest. 1893 was a thoroughly unsatisfactory year, prices continued to fall, crops were short, and unemployment increased. There was an abortive revival in 1894, but prices remained low, and unemployment serious. By 1895, however, the revival had gained sufficient headway to be able to withstand the depressing effects of bad harvests, low prices, and political trouble with the United States. There was no great expansion, however, and 1896 was a dull year. 1897 saw a great improvement in industry and the domestic trades, but exports declined. Full prosperity was reached in 1898, continued in 1899, in spite of the war in the Transvaal, and reached the crest in 1900. A decline set in towards the end of 1900 and resulted in a slight depression in 1901. The depression did not become

severe—1902 was a dull year, with low prices and unemployment, to some degree offset by an increase in export demand and an improvement in agricultural conditions. There was little improvement in 1903. Wages and employment remained low, wild fluctuations in the price of American cotton had unfortunate effects on the domestic trade, and wholesale prices continued to fall. Depression held throughout most of 1904, although there were gains in foreign trade. A boom in export demand brought about a definite upward swing in 1905. Exports increased further in 1906, and prices rose. The money market was, however, stringent, and interest rates were at 6 per cent part of the time. There was an exceptional volume of business in 1907, but the activity culminated early in the year. A “quiet and uneventful” crisis occurred, and business fell off rapidly towards the end of the year. 1908 saw a rapid decline into a state of depression. The export trade was slight, railway receipts declined sharply, employment fell off, wages were reduced, and bankruptcies became numerous. Prices were low throughout 1909, but trade recovered during the summer. Towards the end of the year there was a vigorous and general revival of industry. 1910 was, on the whole, prosperous. Labour disputes in 1911 and 1912 seriously retarded the manufacturing industries. The peak of prosperity was reached early in 1913, with a definite recession in the last months of the year.

The following series, shown in Chart I, are used to represent the typical movement of British business cycles :—

Quarterly Indices .—

- A. Exports of British Produce.
- B. Sauerbeck Index Numbers : All Materials.
- C. Percentage Unemployed : All Trades.
- D. Blast Furnaces in Blast.
- E. Percentage Unemployed Ironfounders.
- F. Railway Freight Traffic Receipts.
- G. Provincial Bank Clearings.

Annual Indices .—

- A. Exports of British Produce.
- B. Sauerbeck Index Numbers : All Materials
- C. Percentage Unemployed . All Trades.
- D. Production of Pig Iron
- E. Production of Coal.
- F. Railway Freight Traffic Receipts.
- G. Provincial Bank Clearings.

The selection of satisfactory statistical indices to represent the ebb and flow of business is beset by difficulties. In the first place, the series selected must move synchronously. There is frequently a difference of two or three years between the maxima of two representative series of business statistics, although both move in cycles. Series must be selected which reflect closely the general business situation, and series which are so sensitive that they forecast the general movement, as well as those which lag behind considerably, must be discarded. The series must also be as widely representative as possible

of all of the most important phases of economic activity which are affected by the business cycle. It is, therefore, necessary first to decide upon one or more standard series which are the best barometers of general business conditions, and select other representative series which tend to move synchronously with the standard. Modern analysis of the business cycle tends more and more to be in terms of prices, and a price index seems to be the best single representative of the general state of business. Sauerbeck's index numbers for "all materials" were taken as the best price index for this purpose. The state of foreign trade is equally important in describing British business cycles. Exports are especially important because so large a part of the output of the leading industries enters into foreign trade. Of several indices tested, the Harvard Committee on Economic Research accepted the total value of exports of British produce as the most satisfactory. This series was accepted for this barometer also. The barometer must also be weighted for the constructional industries, which tend to be most sensitive to cyclical disturbances. The iron and coal trades represent the most important aspects of modern production. Pig iron is the most sensitive index of the state of the iron industry, so a series representing pig iron production, and one representing coal production, were included. For the quarterly series the number of

blast furnaces in blast was used instead of pig iron production, because the former extended over a longer period. The freight carried on the railways is the most satisfactory series representing the state of domestic trade, so the freight traffic receipts of sixteen important railways were included in the barometer. It was impossible to obtain a really satisfactory series showing the cyclical movements in credit facilities for a period sufficiently long to extend through the whole barometer, but the clearings of Manchester and Birmingham were available from 1881, and were included. Finally, the percentage of unemployed, as given by trade union reports to the Board of Trade was added, as being the best available index of the state of employment in general. For the quarterly indices, the percentage of unemployed ironfounders was included for the earlier years

These indices were found generally to synchronize as to maxima and minima—and therefore to give a picture of the general cyclical movement. The use of as many as seven series has the advantage that, in a barometer composed of their averages, individual peculiarities of any aspect of trade not common to trade in general tend to be smoothed out.

Chart I shows the cyclical movement of the indices of business conditions. The data were reduced to a form where the cyclical movement was isolated as far as possible in each of the business series, and then

an average was constructed of the cycles of the several series. The statistical justification of the methods used is given in Appendix A.

The selection of series to correlate with the business cycle was determined partly by technical considerations. Series which were seriously inaccurate were forthwith excluded. Series were not excluded because they presented an inadequate picture of the social phenomenon at any one time, provided they could be considered representative of the general movement of that phenomenon. If the error in a series tends to remain the same, the fluctuations from year to year are quite comparable. This study is not concerned, e g with the absolute amount of crime in any year, but with the amount in any year in relation to amounts in preceding and following years.

The selection was also based on the a priori probability of any particular social series being influenced by the business cycle. Thus, there is a certain amount of evidence that tuberculosis is most prevalent among the poorer sections of the community. One might, therefore, suppose that deaths from tuberculosis (the only available index of the disease) would vary directly with pauperism and inversely with the business cycle, and the series should be tested by the correlation method. But, in the case of deaths from cancer, the causes are more complex, and the medical researches too

limited to give the basis for any supposition of a connexion with the business cycle. Examination of the series showed the connexion, if any, to be slight—and, since a correlation coefficient between such a series and the business cycle would be practically uninterpretable, the series was discarded.

Another criterion of judgment was based on previous research which had shown that the marriage-rate, pauperism, and alcoholism (see Chapter II) were highly correlated with the business cycle. All phenomena which would be affected by a depression or rise in the marriage-rate, as the birth-rate, illegitimacy, prostitution, crimes against morals; by a rise or depression in pauperism, as the tuberculosis death-rate, infant mortality, larceny, etc.; or, in alcoholism, as prosecutions for drunkenness, crimes of violence, etc., were tested by the correlation method for a connexion with the business cycle, in the expectation that a relationship would be shown, partly through the direct effect of the business cycle, but perhaps even more an indirect influence through their close dependence on fluctuations in the marriage-rate, pauperism, and alcoholism.

Since the object of this study is the comparison of the cyclical movements of business series and series of social phenomena, it is important to eliminate, as far as possible, all other factors in order to find the real correspondence between the cyclical movements.

In most series of this sort, extending over a period

of years, there will be a general movement upward or downward, a so-called "secular trend". The trend has been steadily upward in most economic series, a phenomenon due, in part, to the growth of population, but, even more, to the increased productivity of industry, as, e.g. in the production of pig iron. In the case of wholesale prices, a distinct change in trend occurs during the period under consideration. There was an upward movement until about 1865, a downward movement until 1897, and then a further upward movement. These changes are probably due to changes in the amount of gold and to other monetary phenomena.

In the social series there may be a general upward movement due to the growth of population, but it is customary to eliminate this influence at once by expressing the data of any year as a percentage of the population of that year. This, however, does not usually eliminate the whole of the secular trend, which may have other causes. In the case of marriage-rates, for instance, there are changes in trend due to definite changes in the proportion of persons of marriageable ages to the total population. In the case of infant mortality there is a downward trend from about 1900, due to general medical advances and effective campaigns to save infant life. The steady fall of the birth-rate is notorious. The divorce-rate has steadily increased, possibly because of the development of conditions favourable to

divorce. It is obvious that a movement whose fluctuations are influenced by such a variety of special causes must be removed before the series can be in comparable form to measure the correspondence of cyclical variations.

The secular trend is eliminated from each of the series by fitting a curve representing the long-time movement, taking the percentages of the original data to the line of secular trend, and dividing these percentages by their standard deviation—giving the series of cycles shown in the graphs. These series are each, in turn, correlated with the series representing British Business Cycles. A “coefficient of correlation” is computed. The coefficient of correlation is an index of the degree of relationship. If it is very high and approaches $+1$ (its highest possible positive value) it indicates that the business series and the social series usually move together, and in the same direction. If it is very high and approaches -1 (its lowest possible negative value) it indicates that the business cycle and the social series are closely related, but move in opposite directions. If the coefficient equals 0, it indicates an absence of correlation between the business cycle and the social series. Intermediate values indicate more or less connexion with the business cycle. A further, and more technical discussion of the implication of this coefficient, and its interpretation in this study is found in Appendix A.

In each of the tables appended to the chapters are found the correlation coefficients between the business cycle and some specific social series.¹ These coefficients are computed for the whole period for which the data is available, and for shorter periods of years to show any progressive tendency for the correlation to become stronger or weaker in the later years. They are computed not only for synchronous items but also for items lagging one, two, and three years behind the business cycle—for frequently the response of a social phenomena to the business cycle is delayed several years. The coefficients of correlation are expressed with their standard deviations representing—as described in Appendix A—a rough measure of their significance.

Readers who do not wish to accept my interpretations at face value are urged to turn immediately to Appendix A where I have fully described the basis of these interpretations.

¹ The tables in Appendix B show the original data for these computations, the formulæ of the lines of secular trend, and the percentage deviations of the original items from the secular trend, in terms of their standard deviations.

CRITIQUE OF PREVIOUS RESEARCHES

CHAPTER II

A CRITIQUE OF PREVIOUS RESEARCHES INTO THE SOCIAL ASPECTS OF THE BUSINESS CYCLE

: PART I

The Economists

BOTH the excesses of a boom and the repressive influences of a depression tend to leave an imprint upon the social life of the people. To what extent and in what spheres of activity these influences show themselves is the subject of this investigation. Do marriages and legitimate births decrease in times of depression? Is there simultaneously an increase in prostitution and illegitimacy? Do the repressions of a period of business depression increase divorce? To what degree do the fluctuations in crime correspond to the fluctuations in business? Does excessive alcoholism accompany a boom? Do deaths and disease increase in a depression? When the economic situation at home precludes the possibility of earning a living for a large number of people, and unemployment presses hard upon them, do they emigrate?

These questions suggest the line of the present inquiry, and point to the importance of further

investigations into the social aspects of the business cycle. The subject has long been of interest to economists, sociologists, criminologists, and statisticians, but has received no wholly adequate treatment in which the relationships between these various social phenomena and the business cycle have been classified and expressed in quantitative terms. The subject has usually received scanty treatment from the economists, whose chief interest has been the purely economic aspects of business cycles. In certain descriptive accounts of the business cycle, however, the subject of its social aspects is given in some detail. I will review briefly the chief conclusions of those economists who have dealt with the subject most adequately and who have expressed their results, however crudely, in quantitative form.

The Belgian economist, Denis, has made several contributions to the study of depressions and their social effects. The more important of his conclusions are brought out in one of his earlier books : " La Dépression économique et sociale et l'histoire des prix " ¹ In the first chapter he differentiates between a crisis, which is sharp, violent, and of short duration and a depression which is " une crise prolongée, une rupture de l'équilibre économique dont les causes générales persistent. C'est par

¹ Hector Denis, *La Dépression économique et sociale et l'histoire des prix*, Bruxelles, 1895.

cette prolongation même que la depression envahit peu à peu l'ordre moral ; un affaissement moral accompagne le ralentissement de la vie économique. Les fonctions de la vie spirituelle des sociétés subissent le contre coup des perturbations de leur vie organique et économique ; le découragement des mariages marquera le manque de foi dans l'avenir ; le progres du suicide et de la criminalité sera le rayonnement sinistre de la rupture de l'équilibre économique''.¹

In the fifth chapter, he shows that the long accepted correlation between marriages and the price of wheat had long since ceased to hold because the extension of capitalist production had freed the course of prices from any great dependence on the supply of wheat. From about 1870 marriages seem to vary inversely with the price of wheat. In Denis' earlier researches, he used the price of pit coal (houille) as an index of the activity of general business, but later formed index numbers based on the prices of many commodities. He gives tables and charts showing the relation between fluctuations in the price index and marriages and births in Belgium from 1850-87. "Les tableaux montrent que le nombre des mariages et des naissances tend à croître avec l'élévation des prix des produits et des salaires en argent et à s'abaisser dans les périodes de

¹ Op. cit., pp. 1-2

depression.”¹ Indeed, it may be concluded that “Les variations de la matrimonialité et de la natalité d’année en année sont un indice du degré de prospérité de la nation.”²

Denis points out that the downward *trend* in the birth-rate occurred in spite of the stability of real wages, and attributes it to the adoption of a higher standard of life and the attempts to maintain this standard. Denis gives a most elaborate set of diagrams showing comparative price movements, trade movements, and the relation of “phénomènes moraux et politiques et les prix”. Table XXVI shows for Belgium the marriage-rates, emigrations, excess of births over deaths, death-rates, birth-rates, the price of a hecolitre of grain, and general index numbers for 1865–88. Table XXVIII is entitled “L’état économique, la matrimonialité et la criminalité”, and shows the relations of marriages to inhabitants, the number of delinquents condemned to prison, the absolute number of marriages, the suicide-rate, price of grain and index numbers, 1840–90. These charts are impressive, but difficult to interpret. Denis concludes that crime and suicide fluctuate inversely with marriages and births, and that “les phénomènes de pathologie morale sont le terrible rayonnement des perturbations économiques,

¹ *Ibid.*, p. 151.

² *Ibid.*, p. 148.

on en jugera par le seul développement du suicide et de la criminalité depuis l'origine de la depression des prix ".¹

Lescure considers the influence of the business cycle on certain social phenomena. The first part of his book ² is devoted to a description of each crisis and depression from 1810 to 1907 for France, Germany, England, and, for the later years, the United States also. In connexion with most of these crises, he considers their influence upon marriages, criminality, and, occasionally, upon emigration and poor relief. He does not present series of such statistics for comparison, but shows only the increase or decrease in the year of the crisis as compared with the years immediately preceding and following. His final conclusion is that the effects of a crisis are disastrous to industry, but that it is more serious still in its social effects. "En un mot, c'est une véritable révolution dans le monde de la finance et de la speculation. C'est aussi une révolution, mais plus triste, plus grave, plus douloureuse, dans les rangs de la classe ouvrière. Sans doute, le remaniement du revenu n'y est pas, considéré pour cent, aussi considerable que dans la classe capitaliste, mais c'est cette tranche du revenu qui sert à entretenir l'existence

¹ Ibid, p. 156.

² Jean Lescure, *Les crises generales et periodiques de surproduction* (1910, Paris).

du père de famille et de ses enfants qui est atteinte, et, si les coups y sont moins rudes, ils portent sur une partie plus sensible. C'est le chômage, avec ses terribles conséquences: mendicité, vagabondage; c'est la diminution du taux des salaires, du temps du travail du salaire annuel, et non seulement du salaire nominal, mais du salaire réel. Et avec la diminution du salaire, c'est la diminution du nombre des mariages, souvent l'augmentation du nombre des suicides et des décès; c'est aussi un recours plus large à l'assistance. C'est enfin souvent l'explosion de troubles politiques graves."¹

Part of Beveridge's treatise on Unemployment² is devoted to the effects of cyclical fluctuation in trade upon employment and upon the social activities. He presents tables and curves representing the fluctuations in production and employment and showing that they are "more or less closely reflected in almost every series of commercial and social statistics".³ One chart has the very suggestive title "The Pulse of the Nation"⁴ and shows the cyclical movement from 1856-1907 in foreign trade, the bank-rate, employment, the marriage-rate, indoor pauperism, consumption of beer, and the capital of companies registered.

¹ Op. cit., pp 429-30.

² William H. Beveridge, *Unemployment: A Problem of Industry*, London, 1912.

³ Op. cit., p. 41.

⁴ Ibid., p. 44.

Beveridge considers that the fluctuations in the series in this chart map out the economic and social history of the nation, for "the influence of this movement is felt in almost every department of human life".¹ "The tendency to matrimony is undoubtedly related to the comparative prosperity or adversity of the times. The marriage-rate shown in the chart rises and falls with the bank-rate, the value of foreign trade, and the employed percentage . . . The influences which favour matrimony also favour drinking. The consumption of alcoholic liquors per head of the population increases as a rule in good years and decreases in bad ones . . . The consumption of alcohol leads to drunkenness, and drunkenness is not only at times in itself an offence against law and order, but also the fruitful source of other offences . . . The yearly number of prosecutions (for drunkenness) per 100,000 of the population tends to rise and fall in close dependence upon the bank-rate, the employed percentage, and all the other indications of prosperity" ²

In regard to crime, Beveridge holds that no generalization is possible because of the complexity of the phenomenon. He admits, however, that "there is some ground for saying that assaults and minor crimes of violence, having their origin

¹ Ibid., p 46

² Ibid., pp 46-7

very often in drunkenness, tend to be more frequent in years of good trade and less frequent in years of bad trade. On the other hand, the pressure to steal is increased by adversity".¹ In regard to pauperism "a striking correlation with the state of trade and employment becomes evident".² He notes also that the pauperism index lags one or two years behind employment and trade.

The most thorough investigation of the social aspects of the business cycle by any of the theoretical economists has been by Tugan-Baranowsky, who was concerned entirely with conditions in England.³ The greater part of his book on *Les crises industrielles en Angleterre* is devoted to "conséquences sociales des crises". Tugan-Baranowsky's thesis is, in brief, that the social disasters which had tended to follow crises showed a progressive diminution from 1825-1900. He divides his study into three periods, and deals with statistics of marriages, births, deaths, pauperism, and crime in their relation to industrial crises (as shown by the fluctuations in the curve of exports). He does not deal with statistics for the whole country, but takes two samples, one composed of the agricultural counties, Cambridge, Essex, Norfolk,

¹ *Ibid*, p. 47.

² *Ibid.*, p. 48.

³ M. Tugan-Baranowsky, *Les crises industrielles en Angleterre*, Traduit sur la 2e édition par Schapiro, Paris, 1913. See also an earlier contribution, *Die sozialen Wirkungen der Handelskrisen in England*, Archiv für Soziale Gesetzgebung, xii, 1899.

Oxford, Lincoln, Suffolk, and Wiltshire ; the other being the two counties, Lancashire and Cheshire, which were even then highly industrialized. His argument is that, if crises are really a great factor in the social life of the people, their effects will be manifested much more strongly in the industrial than in the agricultural groups. He shows that the first period—1825-40—was a period of great industrial development, which resulted in maladjustment of the workers, due partly to the prevalence of casual labour and the competition of the domestic system with the factory system ; partly to the complete separation of the worker from the land ; to the displacement of skilled by unskilled labour, of men by women and children, of the southern counties by the northern, etc. ; and finally, to the complete absence of effective trade unions. Tugan-Baranowsky exhibits diagrams to show the very close connexion between fluctuations in the social life of the people in the industrial counties and industrial crises and the almost complete lack of any such connexion for those of the agricultural counties. In the agricultural counties marriages increase, deaths and crime and pauperism decrease, following a good harvest. The effect of the Poor Law of 1834 was a sharp decrease in marriages, a considerable rise in crime, and a decline in the number of paupers relieved. “ Il est évident que le pauvre a souvent préféré la risque de la prison

à l'incarcération inévitable dans la maison de travail." ¹ In the industrial counties he finds an invariable connexion between crises, a decrease in marriages, and an increase in pauperism and crime. He alleges also an almost invariable increase in mortality following a crisis, pointing out that the mortality was higher during the crisis of 1847 than during the cholera epidemic of 1849, claiming, from this coincidence, that "une crise industrielle faisait plus de morts qu'une épidémie". ²

For the second period, 1850-70, he finds the correspondence between crises and social conditions less regular. He accounts for this change by the fact that the balance had turned somewhat in favour of labour, due to the factory laws, development of trade unions, and the disappearance of domestic industry. He finds little evidence of any connexion in the agricultural counties between crises and social phenomena, although he claims the effects of good and bad harvests are seen in the irregular movements in the curves of marriages, pauperism, and crime, and to some degree in the curve of mortality. For the industrial counties, there is a high correlation between the curves of marriages and pauperism: "Presque toujours, lorsque le nombre des indigents augmente, le nombre des mariages baisse, et vice-versa" ³ He does not

¹ *Les crises industrielle en Angleterre*, p. 300.

² *Op cit*, p. 303.

³ *Ibid.*, p. 320

find an invariable connexion between crises and crime and mortality.

From 1870-1900, Tugan-Baranowsky contends, there is a distinct change in the nature of industrial crises. The crises from 1870 onwards are usually of a financial nature, and depressions are less intense. England has lost her industrial supremacy, and industry is tending to slow up. The workers are in an advantageous position, due to the development of "class consciousness", the growing power of trade unions, the rise of co-operatives, and advanced factory legislation. "Par suite, l'influence du cycle industriel sur la vie nationale est devenue bien plus faible."¹ He calls attention to the fact that a decrease in pauperism, mortality and crime, in the agricultural counties, shows an improved situation among the agricultural labourers, but that a decrease in marriages might prove the contrary. He finds that marriages and pauperism still retain their inverse relationship in the industrial counties, but that variations in the curves of criminality and mortality occur much less regularly. The depression of 1878-9 brings a strong rise in pauperism and criminality and a decrease in marriages. At the same time, the death-rate falls, which, according to Tugan-Baranowsky's analysis, "prouve que dans les derniers temps, la stagnation des affaires n'a pas eu ces suites si funestes que

¹ Ibid., p. 326.

pendant la période de 1840 à 1850 ou une crise industrielle faisait plus de ravages que n'impute qu'elle épidémie." ¹

For the last decade of the century, "il est manifeste que les phases du cycle industriel ne déterminent plus comme auparavant d'une manière décisive la mortalité," and, in regard to criminality, "il n'est pas possible de reconnaître dans ses variations le mouvement de flux et de reflux de l'industrie." ² Tugan-Baranowsky concludes that social conditions have almost ceased to reflect the fluctuations of the industrial cycle. The value of his study lies in the fact that Tugan-Baranowsky gives a wide view of the social aspects of business cycles. His use of the historical approach is excellent and gives a long period of comparison. It is, however, extremely doubtful if the statistics he uses for the earlier years have any value. Furthermore, in interpreting the figures and charts, his bias carries him into interpretations which the actual data do not warrant. He tends often to generalize about causes on the slight evidence of particular instances, as when, in discussing the increase of deaths in 1847 (see note 2, p. 32) he concludes that "une crise industrielle faisait plus de morts qu'une épidémie". The crudity of his statistical methods also leads him into difficulties in

¹ Ibid., p. 332

² Ibid., p. 333

attributing changes in long time trend to short time cyclical causes. Some light will be thrown on the validity of his conclusions by the chapters which follow.

Aftalion devotes two chapters of his book on business cycles¹ to their social aspects. The first volume of this book is largely statistical, and traces the periodic fluctuations in prices, income, and the cost of production. In considering the fluctuations in income, he has a chapter on "Les oscillations périodiques du paupérisme et de la criminalité".² Tables show the fluctuations in pauperism in England and Wales, and of criminality in France, England and Wales, and Germany. The maxima are italicized and shown to occur at or immediately following the year of crisis.

Aftalion is very careful of his conclusions from these figures, remarking only that "dans certaines pays, et d'après certaines des statistiques, avec plus ou moins de régularité, s'observe d'un certain rythme".³ Aftalion calls attention to the fact that depression may benefit a part of the working class since money wages decrease slowly and real wages may actually increase, but that, for that part of the population which is subjected to partial or complete unemployment, a depression brings

¹ Albert Aftalion, *Les Crises périodiques de Surproduction*, Paris, 1913.

² Op. cit., chapitre v, tome 1.

³ Ibid., p. 168

grave social consequences. "Et par un enchaînement funeste de répercussions successives, l'extension du chômage entraîne un accroissement périodique du paupérisme. Cet accroissement à son tour à cause de la misère tentatrice, détermine une progression périodique de la criminalité."¹

In another chapter² he deals with "l'influence des revenus sur le rythme de la nuptialité et de la natalité". In tracing the economic influences upon the marriage- and birth-rates, Aftalion distinguishes between the secular and the cyclical movements. He calls attention to the fact that, whereas a sudden increase of income, as during a boom, may cause the marriage- and birth-rates to rise, a gradual increase in well-being, resulting in a higher standard of life, may very well cause a downward trend in marriages, and, more particularly, in births. The appendix to this chapter contains tables showing the marriage- and birth-rates for France and Germany and their connexion with economic crises.

PART II

The Criminologists

Most of the earlier writers who dealt with the relations of crime and economic conditions were concerned with the influence of fluctuations in

¹ Ibid, p. 169.

² Ibid, chapitre x, tome 1.

the price of grain upon crimes (usually thefts). But, since these investigators were dealing with countries rapidly becoming industrialized, their series, quite naturally, fail to show that invariable relationship between high food prices and crime, which they so often claim, is apparent. The criminologists seem to me to be the worst offenders in their treatment of economic influences on social life. They have made no real attempt to measure the relative influence of economic influences upon crime. They use and abuse statistics outrageously, presenting short series, frequently of less than ten years, and claiming general causality from such comparisons as could be made with these short series. A review of the literature on the subject suggests that discussions of the relations of crime and economic conditions are still in the realm of metaphysics. An exhaustive survey of the literature bearing upon the subject is found in Bonger's *Criminality and Economic Conditions*.¹ The following summaries deal with those writers whose conclusions are based on fairly adequate series of statistics extending over at least twenty years, and who make efforts to base their conclusions on the statistical facts they present. The summaries are based largely on Bonger's excellent abstracts, but, in all cases, reference has been made to the original sources.

¹ William A. Bonger, *Criminality and Economic Conditions*, transl. by H. P. Horton. The Modern Criminal Science Series, Boston, 1916.

Moreau-Christophe¹ claims 'a causal connexion between pauperism and crime in England. The growth of pauperism due to the spread of industrialism, according to him, brought with it an increase in criminality. The conclusions are based on averages from 1814-47, and are concerned only with secular movement.

Mayr, dealing with conditions in Bavaria,² emphasized the need of considering statistics of the number of crimes known to the police. He shows by charts and tables the relations between fluctuations in the price of grain and in the number of crimes known to the police. He separates crimes against property, which, he says, vary directly with the price of grain, and crimes against the person, which vary indirectly. His studies embraced conditions in Bavaria, England, and France. Their value lies in the attempt to separate the different kinds of crime, and to trace the relationship between cyclical rather than secular fluctuations.

Corne,³ dealing with French statistics of crime, claims that the connexion between the price of grain and the fluctuations in crime is largely accidental. He deals with some of the figures from which Mayr drew opposite conclusions.

¹ L. M. Moreau-Christophe, *Du problème de la misère et de la solution chez les peuples anciens et modernes*, tome III Paris, 1851

² G. v. Mayr, *Statistik der gerichtlichen Polizei im königreiche Bayern und in einigen anderen Ländern*, München, 1867

³ A. Corne, *Essai sur la criminalité*, Jour des Economistes, 1868

Weisz,¹ using the figures for crime in general, and crimes against property for France, 1845-64 and Belgium, 1841-60, shows that there is a close connexion with fluctuations in the price of wheat.

Starcke, dealing with Prussian statistics,² made a great advance over his predecessors by using bankruptcy as a business index as well as the price of grain, and pointing out that, in the later years of the period he was studying, commercial crises tended to increase crime, as well as periods of high prices of grain. He divides crime into numerous classifications and shows that it is chiefly thefts which vary with prices. He also points out that marriages and births vary inversely with thefts.

Meyer,³ in dealing with statistics for Zürich, 1853-92, calls attention to the lag in crime after the price of food. He also emphasizes the fact that the influence of the price of grain upon criminality is evident only when such prices are relatively free from industrial influences. He shows that crimes against property vary directly with business failures. Crimes against persons increase as economic conditions improve. Such crimes are also affected by the abundance of the vintage.

¹ B. Weisz, *Ueber einige wirtschaftliche und moralische Wirkungen hoher Getreidepreise*, Jahrbuch für Nat. Oek. u. Stat., 1881.

² W. Starcke, *Verbrechen und Verbrecher in Preussen*, 1854-78. Berlin, 1884.

³ A. Meyer, *Die Verbrechen in ihrem Zusammenhang mit dem wirtschaftlichen und sozialen Verhältnissen im Kanton Zürich*, Jena, 1895.

Tarnowski¹ presents figures to show that crops are a cause of fluctuations in general criminality in Russia from 1874-94.

Muller,² dealing with Prussian statistics of crime, says, "it will appear that, with time, the state of industry, the greater or less chance to get work, the activity of depression of the general economic life, have gradually become of far more significance for the increase or decrease of crime than a rise or fall in the price of provisions, and that, at present, these factors have reduced the economic meaning of the price of provisions to a minimum."³ He shows that crimes against property increase in the years of high prices up to 1855. In 1857 prices fell and crime decreased. He points to a similar condition for France, but finds no connexion in England between the price of grain and conditions of criminality. He explains this fact by the earlier industrial development of England.

Fornasari di Verce⁴ deals with statistics for Italy, by districts and wealth per head, and shows that wealth and criminality present a certain symmetry. Rural thefts increase when the harvests

¹ E Tarnowski, *La delinquenza e la vita sociale in Russia*, Revista italiana di sociologia, 1898.

² H Muller, *Untersuchungen über die Bewegung der Kriminalität in ihren Zusammenhang mit dem Wirtschaftlichen Verhältnissen*, Halle a S, 1899

³ Bonger, loc cit, p 74 (Muller, loc cit, p 4)

⁴ E Fornasari di Verce, *La criminalità e le vicende economiche d'Italia dal 1873 al 1890 e osservazioni sommarie per il Regno Unito della Gran Bretagna e Irlanda (1840-90) e per la Nova Galles del Sud (1882-91)*, Torino, 1894

are deficient. The effect of a fall in the price of food is to diminish crime greatly. Commercial and industrial crises also tend to cause crime to rise. Dealing with the influence of economic occurrences upon criminality in Great Britain and Ireland, the author compiles the following table : ¹

| | | | | |
|---------------------------|---|------------|--|---|
| CRIMES AND MISDEMEANOURS. | NOT SUBJECT TO THE INFLUENCES TO THE IN-FLUENCE OF ECONOMIC OCCURRENCES, AND VARYING WITH THEM. | INVERSELY. | Much | { Crimes against Property without Violence |
| | | | Moderately | { Crimes against Property with Violence. |
| | | | Little | { Crimes against Property with Premeditated Destruction. |
| | | | | { Crimes other than those named above and those against persons and against the currency. |
| | | DIRECTLY. | { Crimes over which the influence of alcohol is predominant. | { Crimes against Persons |
| | | | Not at all. | Misdemeanours and Contraventions. |
| | | | Only slightly | Forgery and Counterfeiting. |

It will be interesting to compare this summary with the actual correlations I have obtained between these various classes of crime and the business cycle. (See Chapter VIII.)

Lacassagne ² points out, among other things, the influence of economic conditions on crime. He claims that the number of crimes against property corresponds almost exactly to the fluctuations in the price of wheat, and that all the economic crises make their influence felt.

¹ Bonger, loc cit, p 144

² A Lacassagne, *Marche de la criminalité en France, 1825-80*, Revue scientifique, 1881

Tarde's¹ own researches seem to be based on very slight facts, but he throws a challenge to the criminologists, claiming that they had not examined carefully the influence of economic crises upon crime. He could find no parallelism between them. He claims that crises lead more frequently to suicide than to crime.

Corre² deals statistically with the economic influences on crime and suicide in France, 1843-83. He calls attention to the influence of various factors, such as the price of bread, wage movements, holdings, etc., upon fluctuations in crime. He remarks that "Le crime et le suicide augmentent parallèlement et éprouvent simultanément des recrudescences aux périodes heurtées de la politique et des crises économiques, comme aussi après les grandes guerres"³

Lafargue⁴ deals with much the same data as previous investigators in his study of criminality in France from 1840-86. He points out the influence of crises in increasing criminality and presents a series of charts. His index of economic conditions is the annual number of failures, or a combined index of the number of failures and the

¹ G. Tarde, *Misère et Criminalité*, Revue Philosophique, 1890, also, *La criminalité et les phénomènes économiques*, 5th Congr. of Crim. Anthropology, Amsterdam, 1901.

² A. Corre, *Crime et Suicide*, Paris, 1891.

³ Corre, loc. cit., p. 93

⁴ P. Lafargue, *Die Kriminalität in Frankreich von 1840-86*, Neue Zeit, 1890.

price of flour. He shows the close correspondence between this latter index and thefts. Vagrancy and mendicity take the same course as failures. His charts seem to show that there is no relation between the consumption of alcohol and crimes against morals

Hirsh¹ deals with the effect of marriage restriction upon the encouragement of crime and of prostitution. Marriages increase or decrease as economic conditions grow better or worse, and, in bad times, illegitimacy increases. He gives statistics and charts to show the effect of crises in Prussia on these phenomena

Bonger himself bases certain of his conclusions on the statistics here analysed, and brings in new evidence from statistics for the Netherlands, 1860-90, showing the break-up of the parallelism between crime and food prices after about 1869 and the connexion between bankruptcies and vagrancy, etc., from 1875-82. He finds, however, that the parallelism between thefts and the price of bread continues throughout the period. Bongers's conclusion is that criminality is closely bound up with the present economic system, that "the part played by economic conditions in criminality is preponderant, even decisive".² Thefts and analogous crimes are directly related to pauperism,

¹ P. Hirsh, *Verbrechen und Prostitution*, Berlin, 1897.

² Op. cit., p. 669.

and he finds a close connexion between crimes against the person and alcoholism, which he claims is also caused by economic events. His conclusions seem, however, to arise largely from subjective considerations, for he brings forth little real evidence in his 700 page book.

PART III

The Statisticians

The statisticians have devoted considerable attention to the relationships between economic and social phenomena. Most of them have been concerned with a specific relationship for a limited time, or else with testing the validity of statistical methods applied in tracing these relationships. Their interpretations have been few and guarded, and most of their work of great scientific value.

One of the earliest statistical attempts to compare the fluctuations of marriages with economic fluctuations was made in the Registrar-General's annual reports for England and Wales. The section dealing with the marriage-rate contained also series of statistics indicating the state of commerce. For example, the report of 1878 gives comparative figures for the average price of wheat, the area under wheat, the quantity of meat imported, the number and value of animals imported, the price of potatoes, and the average number of paupers

relieved. A comparison of the fluctuations in these figures and the fluctuations in the marriage-rate indicates that "the continued depression of trade and industry caused a further decline in the marriage-rate".¹ A table follows,² entitled, "Fluctuations in the Marriage Rate of England and some of the Causes which have contributed thereto, 1839-78." Following the marriage-rates of each year is a summary statement of "Current Events and the General State of the Country", and another column indicating "Result of the Harvest". These reports were largely due to Farr's influence. Farr was very much interested in the close connexion between the marriage-rate and general prosperity. He says :³ "The number of marriages in a nation perhaps fluctuates independently of external causes, but it is a fair deduction from the facts that the marriage-returns in England point out periods of prosperity little less distinctly than the funds measure the hopes and fears of the money market. If the one is the barometer of credit, the other is the barometer of prosperity, present in part, but future, expected, anticipated in still greater part." Farr points out that factors affecting the marriage-rate include wars, fluctuations in the price of grain, "the establishment of new, or the extension of old,

¹ 41st Annual Report of the Registrar-General of Births, Deaths, and Marriages in England, p. xi.

² *Ibid*, p. cxvi.

³ William Farr, *Vital Statistics*, London, 1885, p. 68

employments, the periodical epidemics of speculation, periods of public exaltation . . . in fine, the great fluctuations in the marriages of England are the results of peace after war, abundance after dearth, high wages after want of employment, speculation after languid enterprise, confidence after distrust, national triumph after national disasters.”¹

Longstaff, in his public papers, arrives at similar conclusions from examination of the same data . “There is no doubt whatever . . . that successively recurring periods of commercial depression have had a very distinct and very uniform effect in bringing down the marriage-rate.”²

One of the earliest attempts to *measure* the relation between the marriage-rate and trade was made by William Ogle³ He emphasized strongly the fact that in any such study the comparison must be confined to the fluctuations from year to year, since the secular trend introduces an interfering cause. He gives no method for eliminating the trend, but is very careful to confine his discussion to the short-time movements. His method of comparison is graphical. He tries to make the fluctuations in the marriage-rate and the value of exports comparable graphically, to do which he assumes that, because the export value was the

¹ Ibid., p 69.

² Longstaff, *op cit.*, p 15.

³ William Ogle, *On Marriage Rates and Marriage Ages, with Special Reference to the Growth of Population*, J R S S, vol. lxx, June, 1890, pp. 253-80.

same in 1866 and 1888 the marriage-rate should also have been the same for the two years, and he distributes the discrepancy occurring in the marriage-rate between these years. The resulting curve of the marriage-rate from 1857 to 1888 is found to correspond in detail to the curve of export values for the same period. Ogle criticizes the practice of comparing the fluctuations in marriage-rates with the price of wheat, and claims that there is no evidence of any such connexion as far back as 1820. He shows clearly the dependence of fluctuations in the marriage-rate on trade fluctuations and particularly on fluctuations in employment. He also emphasizes the point that the connexion becomes closer as the industrial population tends to replace the agricultural

Hooker's paper on the "Correlation of the Marriage-rate with Trade",¹ represents a great advance in the application of statistical methods to the problem. He points out that the connexion between the marriage-rate and trade per head is not absolute, but merely a correspondence between oscillations. The coefficient of correlation between the two series of rough data is only $+ .18$, because of the dissimilarity of trends. "To correlate the oscillations of two curves, I propose that all deviations should be reckoned, not from the average of the whole period, but from the instantaneous

¹ J R S S, vol. lxxv, 1901, pp 485-92

average at the moment. The curve or line representing the successive instantaneous averages I propose to call the trend."¹ This method of eliminating trend is known as the method of moving averages. Hooker used a period of nine years, centring the average on the fifth year. For the period 1861-95, he found the following correlation coefficients after eliminating trend.

| | | | | |
|----------------------------|------------------|----------------------|---|-------|
| Between marriage-rates and | exports per head | . | . | + .80 |
| „ | „ | imports per head | . | + 79 |
| „ | „ | total trade per head | . | + 86 |
| „ | „ | price of wheat | . | + 38 |

In the correlations of the marriage-rate with trade, the maximum is obtained with marriage-rates lagging about one-third of a year behind trade. The correlation coefficient between marriage-rates and bank clearings, 1876-95 is + .92 with a lag of one year.

Hooker's paper is chiefly concerned with the problem of applying new methods, and he makes no attempt to give a wide interpretation of the results.

Juglar made a slight study of the relation of periodic fluctuations in marriages and births to economic fluctuations.² He attempted an international comparison of movements in the birth-rate for France, England, Prussia, Germany, and

¹ Ibid., p. 486

² C. Juglar, *Y-a-t-il des périodes pour les mariages et les naissances comme pour les crises commerciales?* Bulletin de l'Institut International de Statistique, tome XIII, 1903.

two great cities—London and Paris. He does not eliminate secular trend from his data, and his comparisons are not very clear-cut. He concludes that “périodes de prospérité, de crise, et de liquidation apparaissent sur les tableaux des mouvements de la population, surtout la où intervient la volonté de l’homme, comme pour les mariages et les naissances.”¹

Yule has made valuable contributions to the subject.² He follows Hooker’s method of eliminating secular trend by moving averages and correlating deviations from the trend. He supplies a number of charts illustrating his conclusion that “the closeness of the correlation between the fluctuations in the marriage-rate, trade, and economic variables is noteworthy”.³ He finds the following correlation coefficients:

Between the marriage-rate and Sauerbeck index numbers, 1865–96 + .795

Between the marriage-rate and unemployment index, 1870–95 – .873

Yule makes the point that the interpretation of the correlation is complicated by the fact that those who postpone marriage in one year tend to marry in the next, and that “the divergence of the marriage-rate in any one year from the normal depends . . . not on the postponements caused by unfavourable factors in that year alone, but on the difference between the postponements of that year and the postponements of the year before.”⁴

¹ Op cit, p 10

² G. U. Yule, *On Changes in the Marriage- and Birth-rates in England and Wales during the Past Half Century*, J R S S, vol lxix, pp 88–132.

³ Op cit, p 94

⁴ Ibid, pp 96–7

Yule computes also the correlation coefficients between the marriage-rate oscillations and figures representing the cumulations of the economic factors. This gives the following coefficients :

| | |
|--|--------|
| Between marriage-rates and price differences | + '813 |
| „ „ „ „ unemployment differences | - '921 |

Yule calls attention to the difficulty of getting a real estimate of the postponement rate because of the many factors evolved.

Regarding the economic influences on the birth-rate, Yule says: "It seems a curious fact that, while the relations of the marriage-rate to economic factors have comparatively frequently drawn the attention of statistical writers, their effects on the birth-rate do not appear to have been nearly so fully discussed. Yet such a discussion must form the very basis of the theory of population in a modern industrial state."¹ Correlating the birth- and marriage-rates, 1850-96, he found that the birth-rate lagged behind the marriage-rate by two years, giving a maximum coefficient of + '479. He points out that the economic influence on the birth-rate would, therefore, be partly indirect, due to the correspondence between the marriage- and birth-rates. He concludes, however, that the trade cycle exercises a direct influence also but he does not work out any further coefficients of correlation measuring this direct influence. Yule notes that price movements have probably been

a predominant factor in determining the secular trend in both marriage- and birth-rates. Lucien March,¹ dealing with much the same material as Yule, and using similar methods, arrived independently at similar conclusions. Between marriages and unemployment in England he finds a correlation coefficient of $-.73$, and concludes that "en general, quand le chômage augmente, la nuptialité diminue, quand le chômage diminue, les mariages deviennent plus nombreux." ²

Hector Denis³ tries to render series of social statistics comparable with other series of social and economic statistics by reducing each series to index numbers, with a common base. He reduces marriage-rates, illegitimate birth-rates, suicide-rates, and the proportion to the total population of those sentenced for misdemeanours for each year from 1825 to 1908, on the base 1867-77. In this manner it is possible to get an idea of the comparative fluctuations in these phenomena, and also to compare changes in the direction of the long-time trend. With these index numbers, Denis compares others representing economic prosperity and depression, i.e. general index numbers of prices, of agricultural produce, of the price of coal, of pig iron, of iron ore, and of the values of exports

¹ Lucien March *Comparaison numerique de courbes statistiques*, Jour de la Société de Statistique de Paris, 1905, p. 255 et p. 306

² Loc. cit., p. 274

³ Hector Denis, *Les index numbers des phénomènes moraux*, Mémoires de l'Académie Royale de Belgique, 11 série, tome iv, 1911.

He traces the "concomitant variations" of the several series, finding a close correspondence of trend in the economic series, which, he holds, is reflected also in the trend of the marriage-rates. Although the reduction to index numbers undoubtedly renders the series more easily comparable graphically, it is doubtful whether Denis' study gives any definite results showing the interdependence of the phenomena he is discussing. He has certainly failed to make clear how, from the data presented in this study, he has reached such a definite conclusion that "on marque plus solidement l'interdependance, la subordination des phénomènes sociaux, on jette une plus vive lumière sur cette solidarité dans le temps et l'espace" ¹

Davies ² made a statistical investigation of some of the social aspects of the business cycle in the United States. He uses the wholesale price index numbers as his business barometer, and eliminates trends by means of moving averages. His correlation of marriage-rates, U.S.A., and this index for 1887-1906 gives a coefficient of + 67. The annual admissions to New York state prisons, 1896-1915, correlated with the price index gives a coefficient of - 41. The *per capita* consumption of alcohol in the U.S.A., 1895-1914, gives a coefficient of + 78. Finally, the correlation of the increase in membership in the Congregational and Methodist

¹ Op. cit., p. 6.

² *Social Aspects of the Business Cycle*, G. P. Davies. *Quarterly Journal of the University of North Dakota*, January, 1922.

Churches with the price index for 1875 to 1894 gives a coefficient of $-.67$. The whole study tends, however, to be slightly miscellaneous, although the results are highly suggestive. The methodology is sound except for the practice of basing the correlation coefficients on such short series of years.

Miss Howland,¹ in a statistical study of poor relief in Massachusetts, measures the relationship of the number of the population in Massachusetts in receipt of poor relief, 1892-1920, with an index of wages and with business failures. (The trend is eliminated by moving averages.) The following coefficients of correlation result :

Between the number receiving poor relief and wage index $-.62$
 " " " " " " " " bus. failures $+.44$

The most comprehensive statistical investigation into the social aspects of the business cycle is the one by Professor Ogburn and myself.² It forms the starting point of the present investigation, and is appended to this chapter.

THE INFLUENCE OF THE BUSINESS CYCLE ON CERTAIN SOCIAL CONDITIONS

By WILLIAM F. OGBURN and DOROTHY S. THOMAS, Columbia University³

The influence of economic changes on social conditions has for a long time been a subject of

¹ K. E. Howland, *A Statistical Study of Poor Relief in Massachusetts*, *Jour. Amer. Stat. Soc.*, Dec 1922

² W. F. Ogburn and D. S. Thomas, *The Influence of the Business Cycle on Certain Social Conditions*, *Jour. Amer. Stat. Soc.*, Sept., 1922.

³ The article as originally printed in the *Quarterly Publication of the American Statistical Association*, September, 1922, contains tables of data and corrected "cycles" which are here omitted.

study for historians, economists, and sociologists. We know that changes in the economic system of a people are accompanied by profound social changes. Thus, the industrial revolution of the past century brought changes in political organization, in the family, the position of women, industrial classes, education, etc. Such effects are the materials back of the theory of the economic interpretation of history.

There is, however, another type of economic changes which also occasions social modifications. These changes are not the lasting changes in the economic order but are oscillatory changes of short duration. Thus, while time brings enduring change, there are also brief swings in economic conditions through prosperity and depression, around the line of general economic change. These fluctuations in business conditions occur over short intervals with some regularity and are usually referred to as business cycles. Do these fluctuations in business produce fluctuations in social conditions? Do we find relatively more births, deaths, marriages, and divorces in periods of business depression? Does crime and do other social phenomena fluctuate with the business cycle? Of course the fact that social statistics fluctuate simultaneously with indexes of the business cycle does not necessarily prove a causal influence, that is, that the economic changes produce the social changes. For instance, if the birth-rate is correlated with the business cycle, such

a change in the birth-rate may not be due directly to the business cycle but may perhaps be due to the changes in the marriage-rate, which may correspond to changes in the business cycle. Our first problem, however, is to determine the amount of concurrence in the fluctuations of certain social conditions with the fluctuations of business.

It is possible to measure the amount of this concurrence in several social phenomena, for in some cases we have series of statistics going back a number of years. Furthermore, during the last few years, a great deal of success has been achieved in describing the business cycle, and there also exists the technique for measuring quantitatively the concurrence in fluctuations in time series. In the following pages, therefore, we shall inquire to what extent certain data of marriages, divorces, births, deaths, and crime vary with the indexes of the business cycle. Our first step is to measure the cycles of business during recent years.

I

One difficulty in getting a measure of the business cycles to correlate with social statistics for so large and varied an area as the United States is the diversity of our economic life. Our economic life consists in the main of agriculture on the one hand, and of manufacturing, mining, and trade on the other. The products of agriculture are affected in large part by rainfall and climate; oscillations in

crops were in early times referred to as good years and lean years, famines being the extremes of the lean period. The business cycle is a phenomenon more characteristic of the period of great manufacturing development. However, during the last half century in the United States there has been a fairly close relationship between economic welfare in agriculture and in manufacturing. Prosperity and depression in business affect the profits from agriculture, if not so much the volume of agricultural production.

The problem of procuring data which are representative of the state of manufacturing and commerce has been already satisfactorily met. Business failures, prices, volume of production, banking data, and employment are sufficiently widely representative.

Representative indexes must also have one other attribute. They must fluctuate concurrently. The analyses, particularly of Persons and of Mitchell, show that there are a number of economic series that reach their maximum when general prosperity is at its greatest height and reach their minimum when business depression is at its lowest depth. There are also various other series which, when measured in months, reach their maximum at various intervals preceding or following the peak of general business prosperity. Years of research by various economists have resulted in an excellent description in quantitative terms of the cycle of business based on a

combination of these representative synchronous series.

We wished to take a curve of the business cycle already constructed but could find none covering a sufficient number of years. Most of the curves of business cycles are for very recent years. Persons has carried his data back to 1879, and Axe has constructed a curve by months to 1877, though he has not published an account of how his curve was constructed. Since it was desirable to have as long a period as possible, we have constructed a curve from 1870 to 1920. In working out a single series to describe the business cycle we have chosen to combine the following series :

1. Wholesale prices, 1870-1915.¹
2. Commercial failures, 1870-1920.²
3. Bituminous coal production, 1870-1920.³
4. Pig iron production, 1870-1920.⁴
5. Railroad freight ton mileage, 1882-1920.⁴
6. Bank clearings outside New York, 1881-1915.⁵
7. Employment in Massachusetts, 1889-1920.⁶

¹ *U S Bureau of Labour Statistics, Bulletin 149*, p. 179, and *Monthly Labour Reviews*

² The ratio of commercial failures to firms in business. Dun's Review. *Statistical Abstract of the United States* Dun's figures of the number of firms in business.

³ *U S Geological Survey, Mineral Resources of the U S*, 1917, p. 924 and later releases

⁴ *Statistical Abstract of the U S.*

⁵ *Commercial and Financial Chronicle.*

⁶ Indexes of employment in manufacturing industries in Massachusetts. Ralph G. Burlin, "Three Decades of Employment Fluctuation," *The Annalist*, vol. 18, pp. 387-8, Oct. 24, 1921.

8. Railroad mileage constructed, 1870-88.¹

9 Imports, 1870-88.²

These series have all been studied by others, and their yearly fluctuations are shown to have a high correlation³ and to represent widely different types of economic phenomena. They are also probably sufficient in number to average out certain errors due to inadequacies in fitting trend lines and to such deviations of particular series from the true business cycle as may be found here and there.

The next step was to determine the cycles for each series. The data for most of these nine series when plotted showed a general upward movement for the whole period, with small fluctuations up and down around the line of the general upward movement. (A similar upward movement is seen in the curve of divorce-rates shown in Chart C) To each series lines were then fitted which appeared to describe the general movement. These lines are called the trend lines.⁴ The actual data deviated in each year above or below these trend lines. (In Chart C, showing divorce-rates, similar trend lines and deviations of the data from the trend lines are shown.) These

¹ *World Almanack*, 1922, p 184

² Value of Imports U S. National Monetary Commission, Statistics for the United States, 1867-1909

³ Warren M. Persons, "The Construction of a Business Barometer," *The Amer. Economic Rev* , vol vi, No 4, Dec., 1916, and *Indices of General Business Conditions*

The Review of Economic Statistics (various issues)

⁴ See n 1, p 59

deviations of the actual data from the trend for each year were computed in percentages of the trend data for the respective years. Then each percentage deviation was divided by the standard deviation of these percentage deviations for the particular series. The results were the cycles for the particular series in terms of their respective standard deviations as units. The arithmetic mean, unweighted, was then found for the cycles of the nine series. The result is a single series describing the business cycle for the period and is seen plotted as curve A in Chart A.

In constructing this curve showing the fluctuations of business for the past fifty years, the chief methodological difficulty was in selecting the equations¹ of the trend lines that seemed to describe best the general movement of the particular series. As there was no mechanical test to show which particular line best

¹ The trend lines for the various series are the following. The origins for these equations and all others listed are at the midyear of the period unless otherwise stated

1 Wholesale prices, 1870-96, $y = 96.57 - 2.93x + 0.06636x^2$, and, 1897-1915, $y = 90.4 + 1.847x - 0.07335x^2$

2 Commercial failures, 1870-1920, $y = 0.966 - 0.0043x$.

3 Bituminous coal production, 1870-92, $y = 7760.8 + 631.22x + 19.41x^2$; 1902-14, $y = 37374 + 1673x - 54x^2$, and 1914-20 projected

4 Pig iron production, 1870-94, $y = 4218.34 + 306.02x + 6.53x^2$; 1894-1904, $y = 12888.09 + 1140.96x$, 1904-14, $y = 24298.81 + 785.79x$, and 1914-20, projected

5 Freight ton mileage, 1882-1914, $y = 120.88 + 8.076x + 0.2009x^2$, and 1914-20, projected

6 Bank clearings outside New York, 1881-1915, $y = 31389 + 1982.54x + 56.23x^2$.

7 Employment, 1889-1905, $y = 62.47 + 1.818x + 0.1644x^2$, 1905-15, $y = 95.91 + 1.35x$, and 1916-20, projected.

8 Railroad mileage constructed, 1870-88, $y = 5754.37 + 236.3x$.

9 Imports, 1870-88, $y = 5691 + 108x$.

described the true trend of the data, it was largely a matter of judgment of the eye. For instance, one investigator might think that the trend of wholesale prices from 1870 to 1896 was that best described by a straight line, and another investigator might prefer a parabola.

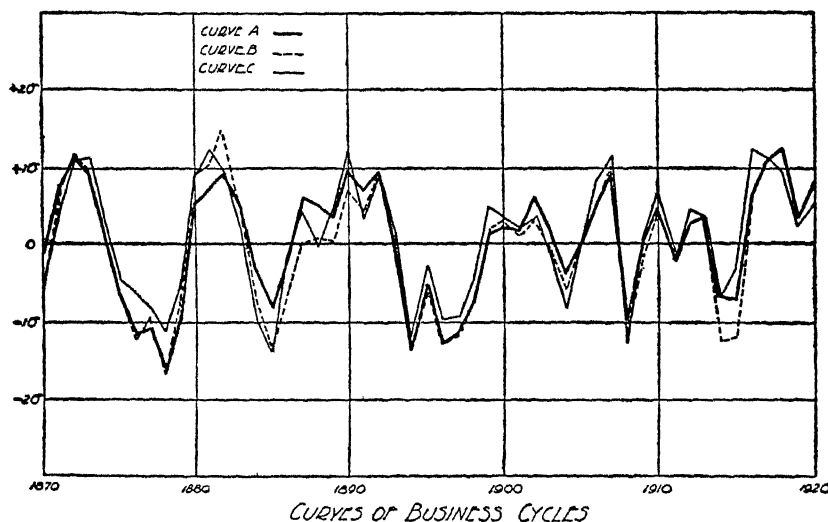


CHART A.

In order to get around this difficulty of individual bias, which as a source of error, however, may be limited, we decided to check our results by constructing another curve of the business cycle by computing the cycles of each series from trend lines consisting of nine-year moving averages.¹ This was done and

¹ The moving averages were plotted at the midyear of each nine-year period. The trend lines of moving averages extended over the following years for the various series :

1. Wholesale prices, 1867-1912
2. Commercial failures, 1868-1914.

the result is curve B' in Chart A. . It is seen to be remarkably similar to curve A, the coefficient of correlation of the two curves being +0.95.

Because of the fact that there may be a variation in preference on the part of different investigators in choosing equations to describe trends, it is of value to compare our curve of business cycles, curve A in the chart with the curve constructed by Axe. Axe's curve is not constructed from identically the same series,¹ and it is for intervals of a month. It was reduced to a yearly basis by adding the monthly cycle indexes and dividing by twelve. As this curve goes back only to 1877, we pieced it out by joining on a cycle from 1867 to 1877 constructed from several economic series available for those

3 Bituminous coal production, 1867-1916.

4 Pig iron production, 1867-1916

5 Railroad freight ton mileage, 1887-1916

6 Bank clearings outside New York, 1884-1911

7. Employment in Massachusetts, 1893-1916

8 Railroad mileage constructed, 1867-86

9. Imports, 1871-92

¹ Axe's curve was published in the *New York Evening Post*, 17th October, 1921, in an article by Wesley C. Mitchell. The curve was not described, the trend lines not given, nor the years covered by the various series. The series combined in the curve were weighted with the following weights:

| | |
|--------------------------------------|----|
| Bank clearing outside New York . . . | 25 |
| Pig iron production . . . | 20 |
| Railroad traffic . . . | 15 |
| Failures . . . | 10 |
| Copper production . . . | 5 |
| Cotton consumption . . . | 10 |
| Coal production . . . | 5 |
| Commodity prices . . . | 10 |

years.¹ The resulting curve, thus extended, is plotted as curve C in Chart A. It is quite similar to curve A, the coefficient of correlation being +0.92.

From the foregoing considerations, then, we think that the cycle series in curve A is a sufficiently satisfactory measure of the business fluctuations from 1870 to 1920 to use in correlation with the data of certain social phenomena.

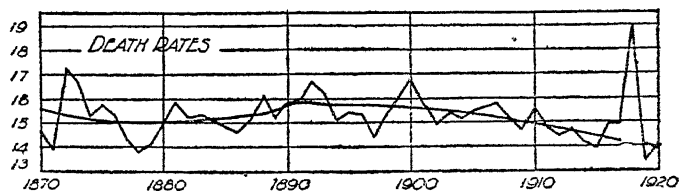
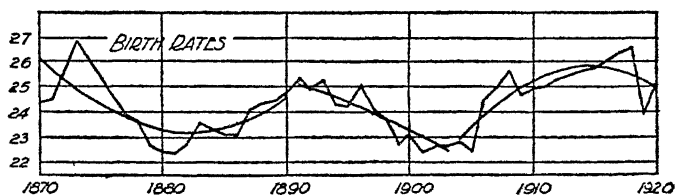
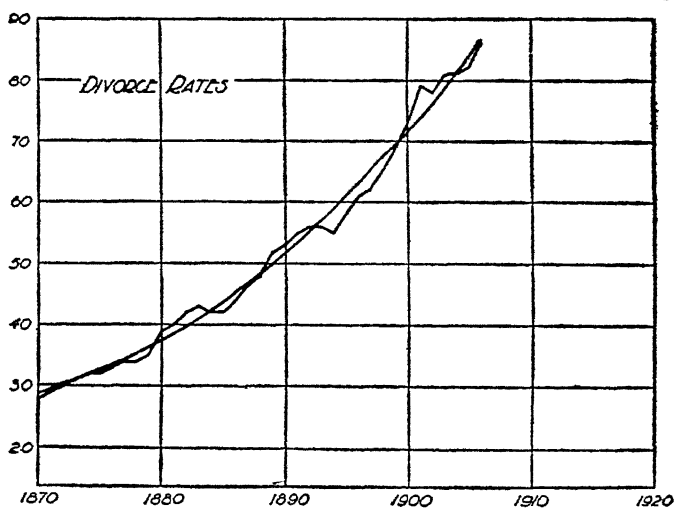
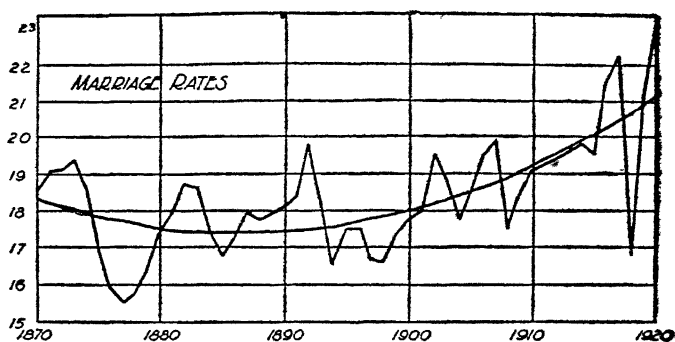
II

For a study of the variations in marriage-rates the only data that have been collected for the United States as a whole are from 1866 to 1906. Since it was desirable to have a longer record, we have collected the figures for the number of persons married during the year for the period 1870-1920 for the States for which satisfactory statistics were available. These States are Connecticut, Massachusetts, Michigan, New Hampshire, Rhode Island, and Vermont.² A parabola³ seems to describe the general movement of the marriage-rates as seen in Chart B. The

¹ The segment from 1867 to 1877 was constructed by averaging the cycles derived from straight-line trends for the following series: Railroad mileage constructed, imports and exports (fiscal years), immigration (fiscal years), pig iron production, bituminous coal production, commercial failures, wholesale prices, cotton consumption. The standard deviations for this segment are based on yearly data, while for the series in Axe's curve they are based on monthly data. There is, for this reason, perhaps some error in joining the two curves, but it does not appear to be large.

² The population of these States, used in computing the rates, was found by interpolation for the intercensal years, on the assumption of a constant rate of change. During the last decade when the changes in population were somewhat unusual, the results of the State censuses helped in making the interpolation.

³ $y = 17.65 + 0.055x + 0.0032x^2$.



CHARTS B, C, D AND E

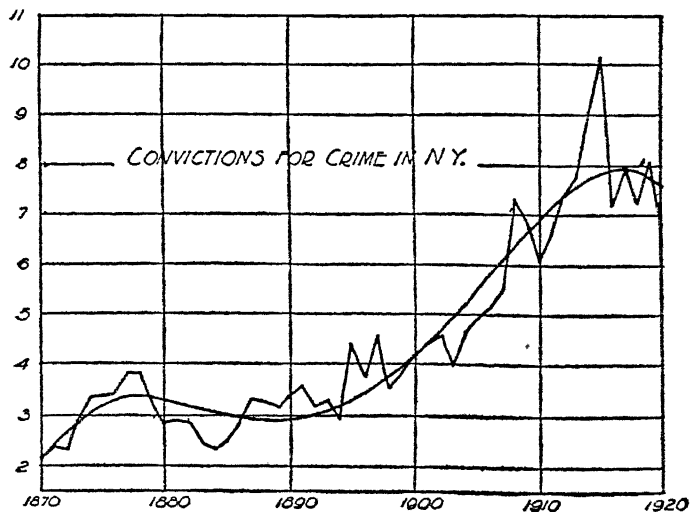
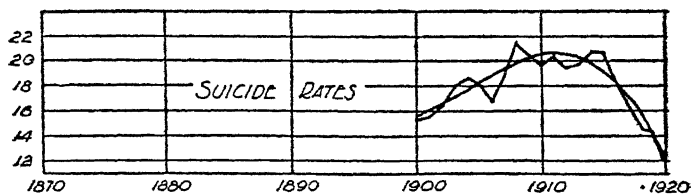
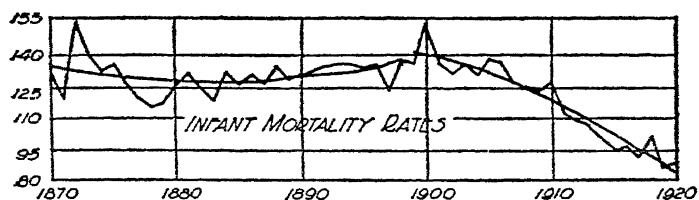
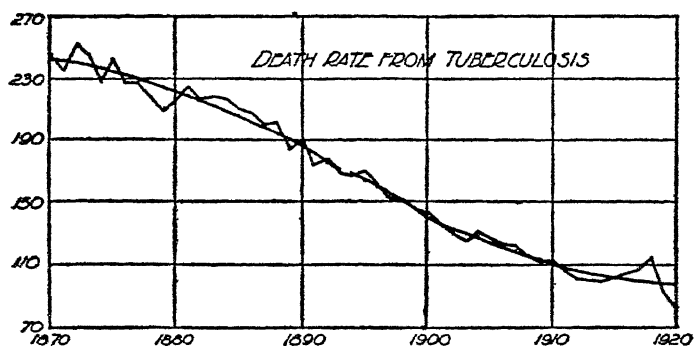
fluctuation of these marriage-rates around the trend appears to be, in general, concurrent with the cycles of business indexes, the coefficient of correlation being $+0.66$. Although in general the marriage-rate increases in prosperity and diminishes in depression, this is rather noticeably not true in the year 1918. The marked drop in the marriage-rate in this very prosperous year is thought to be due to the extraordinary conditions of war time. If we omit from the correlation table the data for the year 1918, the correlation becomes $+0.87$. When the cycles of marriage-rates are computed from a trend of nine-year moving averages their correlation with the business cycles for 1874-1916 is $+0.81$.

Similar results have been found by others. In 1901 Hooker obtained a coefficient of correlation of $+0.86$ between the marriage-rate in England and Wales and the amount of foreign trade for the period 1861-95, the cycles being measured from seven-year moving averages.¹ For the United States, Davies found a correlation between the marriage-rate and wholesale prices, 1887-1906, of $+0.67$.² This checking of results from different data by different investigators leaves no doubt as to the fact that the number of marriages fluctuates with business conditions.

That the marriage-rate should be greater when

¹ R. H. Hooker, "On the Correlation of the Marriage Rate with Foreign Trade," *Jour. of the Royal Statist. Soc.*, vol. lxiv, p. 485.

² George R. Davies, "Social Aspects of the Business Cycle," *Quar. Jour. of the Univer. of N.D.*, vol. xii, No. 2, Jan., 1922.



CHARTS F, G, H AND I.

business is good, and less when business is bad appears to be what one would expect. Yule thinks that one reason for the very large degree of correlation is probably the fact that the non-occurrence of the event in a business depression means in many cases only a postponement until business prosperity returns. The changes in the marriage-rate seem to be practically simultaneous with changes in the business cycle. When the correlation is made between the indexes of the business cycle and changes in the marriage-rates, not of the same year but of the following year, the coefficient of correlation (omitting the data for 1918) is + 0.62, smaller than the coefficient when the correlation is made without the assumption of a one-year lag. Hooker finds that the correlation is a maximum with a lag of about a third of a year. The correspondence in the fluctuations of the marriage-rate and the business cycle seem to be a little closer for the earlier years than for the later year, from both the British and the American data

III

That the divorce-rate¹ is influenced by business conditions was noted by Willcox² as early as 1893. The curve of divorce-rates for the United States from 1866 to 1886, showed low divorce-rates in the

¹ We are indebted to Miss Helen Mack for assistance in the study of divorce-rates and the business cycle

² Walter F Willcox, "A Study in Vital Statistics," *Polit Sci Quar*, vol viii, No 1

periods 1873-9 and 1884-6, which Willcox observed were periods of depression in trade. The similarity in the drops in the curve of divorce-rates and the curve of trade was so close as to lead to the conclusion of a causal relationship.

Since the publication of Willcox's article, the divorce statistics for the United States have been extended to 1906. There has been a marked increase in the divorce-rate, as is seen in the Chart C. Chart C also shows the trend line describing the upward movement.¹ The fluctuations around this trend line correspond quite closely to the fluctuations of the business cycles, the correlation for the forty years, 1867-1906, being $+0.70$ ²

The tendency to secure more divorces in prosperity and fewer divorces in business depression is quite marked, and this conclusion is perhaps surprising. The reason is not clear, although the economic argument is clearer than the psychological. The fact that divorces are expensive, involving lawyers' and court fees and perhaps alimony, may be the reason for relatively more divorces in times of business prosperity. It would be interesting to know whether there are also more desertions in periods of prosperity. It would also be interesting to know what psychological factors are involved in decreasing the divorce-rate in times of business depression.

¹ $y = 46\ 685 + 1\ 542x + 0\ 0289x^2$

² The business cycle curve used in this correlation was constructed from nine-year moving-average trends

On account of the fact that time is involved in the court procedure of granting divorces, we might be led to expect a lag in the variations in the divorce-rate corresponding to the business cycle. The correlation is, however, lower with a one-year lag in the divorce-rates, being $+0.58$.

We have been able to procure the divorce-rates for thirteen States¹ through 1920. The correlation between the business cycles for the United States and the divorce cycles for the thirteen States is lower ($+0.33$) than the correlation between the former and the divorce cycles of the United States as a whole for the shorter period. The lack of correspondence between the divorce cycles of the thirteen States and the business cycles appears to be greater for the earlier years, however, than for the later years. Also, from an inspection of the curves of divorce-rates as published in the census volumes for separate sections of the United States, such as the South Atlantic States and the North Central States, it appears that there is a less close correspondence in fluctuations with the business cycle than there is for the nation as a whole. Just why these samples should show lower correspondences than the whole, we do not know. Possible causes may be changes in laws, migrations, changes in residence, or the influence of crop cycles.

¹ Conn., Ind , Ia., Me , Mass , Mich , N H., Ohio, R I , S D , Utah, Vt., and Wis.

IV

Statistics of the annual death-rate for the registration area go back only to 1900. We were able to obtain the death-rates from 1870 to 1920, however, for the same States for which we secured marriage-rates. The fluctuations in the curve of these death-rates seem to correspond somewhat with the business cycles. The correlation¹ is found to be positive and fairly high, $r = +0.57$, and with cycles from nine-year moving averages, $r = +0.63$. This is a surprising result, as one would guess that if there were any correlation at all between business conditions and death-rates it would be negative, that is, there would be relatively more deaths in business depression and fewer in business prosperity. Such an inference would be drawn, for instance, from the studies of the Children's Bureau, Washington, D.C., which have shown that when the earnings of the father are low, the infant death-rates are high. We are also told that pulmonary tuberculosis is a disease of poverty. The impression that disease is more prevalent in conditions of poverty would lead one to expect more deaths in business depression.

Assumptions of lags do not clarify the matter. With a one-year lag in the death-rate the correlation is $+0.49$, and with a two-year lag it is $+0.03$. If we assumed a four- or five-year lag or longer in the

¹ The trend lines for the death-rates from which the cycles were computed are, for 1870-90, $y = 15.01 + 0.0035x + 0.0062x^2$, and for 1891-1920 (omitting 1918), $y = 15.33 - 0.0654x - 0.0022x^2$.

influence of the business cycle on the death-rate, we should probably get a negative correlation. But what basis is there for such an assumption? Such an assumption would be quite unjustified in the case of infant death-rates. Yet the curve of infant death-rates for these States is quite similar to the curve of general death-rates. Yule has found a correlation of $+0.77$ between the general death-rates in England and Wales and the infant death-rates.¹

The infant mortality-rate shows about the same positive correlation with the business cycle as does the general death-rate, $+0.42$, for the same States and for the same period.² The correlation, when the trend is nine-year moving averages, is $+0.37$. And with a one-year lag in the infant mortality rates the correlations are, for these types of trends, $+0.43$ and $+0.29$. The infant mortality rates, then, like the general death-rates, show the strange result of increasing in prosperity and decreasing in depression.

If the registration bureaux were in the habit of collecting and registering more records in good times and fewer in bad times, this positive correlation would be explained; but persons familiar with the administration of vital statistics assure us that there is no such variation in the registration of death records.

¹ G. Udny Yule, *Introduction to the Theory of Statistics*, chap. v, p. 198

² The trend line for the infant mortality rate from which the deviations were measured for correlation with the business cycle is, for 1870-98, $y = 127.47 + 0.067x + 0.0466x^2$, and, for 1898-1920, $y = 122.04 - 2.73x - 0.072x^2$.

We know that the filing of death records for all deaths does not occur. It has been a long, hard struggle to induce the various States to keep records sufficiently complete to entitle them to be included in the registration area. But even if the statistics of deaths are much less than 100 per cent complete, the partial records might quite conceivably show much the same cyclical fluctuation around a trend that they would if the records were complete. On the other hand, errors in the record may be due to various causes.

It may be that the death-rates for the registration area since 1900 are more accurate than the death-rates for the selected group of States from 1870 to 1900. We have therefore correlated the death-rate for the United States registration area, 1900-20, with the business cycle for that period with the same results, $+0.44 \pm .12$ for the general rates, and $+0.41$ for the infant mortality rates.¹

On account of these unexpected results it is desirable to see if they are borne out by statistics for other countries. We have not found any published results of correlations by other investigators of death-rates and business conditions. We did, however, examine the mortality rates in England and Wales where the registration of vital statistics has been

¹ The trend for the general death-rate, 1900-20, omitting 1918, is $y = 14.69 - 0.192x + 0.00025x^2$, and for the infant mortality rates, determined by dividing the deaths by the population, is, 1900-20, $y = 271.5 - 6.86x - 0.05x^2$.

exceptionally satisfactory. In the absence of a curve of business cycles for England we used as our index of business conditions the amount of foreign trade.¹ The correlation, for the period 1870-1914, of foreign trade with the general death-rate is $+0.02$, and with the infant mortality rate is -0.09 . These results increase our scepticism regarding the existence of a significant correlation between death-rates and the business cycle.

Even if there is no correlation of the business cycle with the general death-rate, there might be a correlation with specific death-rates, although inspection of the curves of some of the classifications of death-rates since 1900 does not encourage such an expectation. For the United States, the fact that few States have records going back to 1870, and that only a small number of cases of deaths from specific diseases is recorded, makes an inquiry somewhat doubtful. We have, however, correlated the cycles² of death-rates from tuberculosis of the lungs for certain States³ with the cycles of business, for the period 1870-1920, and we find a correlation coefficient of $+0.32$. If the year 1918 is omitted the correlation becomes $+0.24$, and with a one-year lag it is $+0.16$. For the United States registration area, 1900-20, the correla-

¹ The trend line for the foreign trade is $y = 716.4 + 14.5x + 0.596x^2$. The trends for other British data were taken from nine-year moving averages.

² Trend, 1870-94, $y = 216 - 3.14x - 0.72x^2$, and 1894-1920, $y = 119.2 - 2.8x + 0.086x^2$

³ Mass., Mich., N.H., and R.I.

tion is $+0.193$; omitting 1918, it is -0.05 .¹ The relationship of death-rates from pulmonary tuberculosis to the business cycle is much the same as that of the general death-rate.

The suicide-rate would be expected, we think, to vary with business prosperity and business depression, and so it does. We have taken the suicide-rate as computed by Hoffman² for one hundred cities of the United States for 1900-20, and correlated the suicide cycles³ with cycles of business conditions for the same period, and we find a correlation of -0.74 ± 0.07 .

From the inquiry, as thus far conducted, into a possible correlation between death-rates and business cycles, we do not draw a definite conclusion of a correlation, except in the case of suicides. The evidence for the United States points toward the conclusion that there are somewhat greater death-rates in prosperity than in depression; but the British data⁴ do not bear out such a conclusion. Although it seemed probable that there would be a negative correlation between death-rates and the business cycle, it should be remembered that there are other factors affecting the fluctuations of death-rates from year to year. Such factors are climate,

¹ Trend $y = 142.7 - 3.4x + 0.034x^2$.

² Frederick L. Hoffman, "Suicide Record for 1920." *Spectator*, 9th March, 1922 "

³ The suicide cycles were measured from the trend line $y = 20.35 + 0.171x - 0.0656x^2 - 0.00348x^3$.

⁴ Author's note. The results of a careful study of the British data show that they do bear out such a conclusion. See Chapter V following.

health education campaigns, developments of preventive medicine, and epidemics. In a period of fifty years there are only a very few cycles, and if there is an economic influence it might be obscured by variations in other factors, although it could be uncovered by partial correlations if we could procure series of data for the other factors.

V

For statistics of births in the United States the birth registration area was created in 1915, fifteen years later than the publication of annual deaths from the death registration area. However, we were able to get birth statistics from 1870 to 1920 from the same states from which we obtained mortality statistics. These statistics of birth-rates are shown plotted in Chart D. Looking at this curve we observe that there would be a little more than two cycles if the trend be assumed to be a straight line, which would give little or no correlation with the business cycles. If we assume a trend with two or three bends in it, then we shall get more numerous cyclical fluctuations. The chart shows the trend lines we have fitted.¹ The moving averages of nine years follow very much the same course as these trend lines. The correlation of the fluctuations of the birth-rate with the indexes of business is +0.06 ;

¹ Trends 1879-90, $y = 23.37 - 0.0836x + 0.0196x^2$, 1890-1904, $y = 23.93 - 0.219x - 0.0041x^2$, 1904-20, $y = 25.62 + 0.135x - 0.0268x^2$.

when the birth-rate fluctuations are measured from the line of nine-year moving averages the correlation is $+0.04$. The birth-rate for England and Wales likewise fails to show a high positive correlation. When correlated with the amount of foreign trade, the British birth-rates, 1874-1910, yield a correlation of -0.31 .

One expects a positive correlation between the birth-rate and the business cycle, if for no other reason than the fact that there are more marriages in prosperity and fewer in depression. But one also expects such a possible positive correlation to appear by comparing the index of the business prosperity, not, say, of a particular year, with the birth-rate of the same year, but with the birth-rate of the year following. Making such a correlation on the assumption of a one-year lag, we find for the selected states, 1870-1920, a correlation of $+0.33 \pm 0.07$; for England and Wales, 1874-1910, it is $+0.15 \pm 0.11$. Our correlations indicate, therefore, that there is a slight tendency for birth-rates to increase in prosperity after a year's lag and to decrease in depression. This may be due in part to the fact that marriages are so highly correlated with business conditions.

VI

It has been said that in periods of acute business depression and unemployment the prisons are filled. In order to measure the correlation between crime

and the business cycle, records are needed extending over a long period of time. The Secretary of State of New York publishes such a record of the number of convictions for criminal offences in Courts of Record. Several other states are reported as having such a record, but we have been unable to secure another state record for an unbroken series of years. Regarding these statistics of convictions, Robinson, in his *Criminal Statistics of the United States*, observes that in no state are the records complete. The statistics are sent in from the different local units, but somewhat irregularly. Although the series for New York State is not complete, it is the best available, and we decided to compare the fluctuations of this series of crime statistics with the business cycle.

Observation of this curve of crime statistics, as shown in Chart I, and its fluctuations around the trend line¹ shows that in most of the depressions the number of convictions is above the normal, as indicated by the trend, and in most of the periods of prosperity the number of convictions is less. The coefficient of correlation is -0.35 ± 0.08 ; when the trend for the data on convictions is for nine-year moving averages the correlation is the same, -0.32 . With a one-year lag the coefficient of correlation is smaller, -0.24 .

The conclusion that there is an increase in convictions for crime in business depression is corroborated

¹ $y = 331.93 + 12.633x + 1.1035x^2 - 1.002512x^3 - 0.00138x^4$.

by Davies,¹ who correlated the annual admissions to New York State prisons, 1896-1915, with wholesale prices and found a correlation of -0.41 ± 0.13 .

The Secretary of State of New York in his report publishes an analysis of the number of convictions, and one of the series is the number of convictions for offences against the person, exclusive of offences against property with violence. It is interesting to inquire whether such offences against the person are correlated with business conditions. The coefficient of correlation is negative, though small, -0.12 ± 0.09 .

Our conclusion is, therefore, that although the records of crime statistics are not wholly satisfactory there does appear to be some negative correlation between convictions for crime and the business cycle, and this conclusion has been corroborated by another investigation from different data.

¹ Loc cit, p 111

MARRIAGES AND THE BUSINESS CYCLE

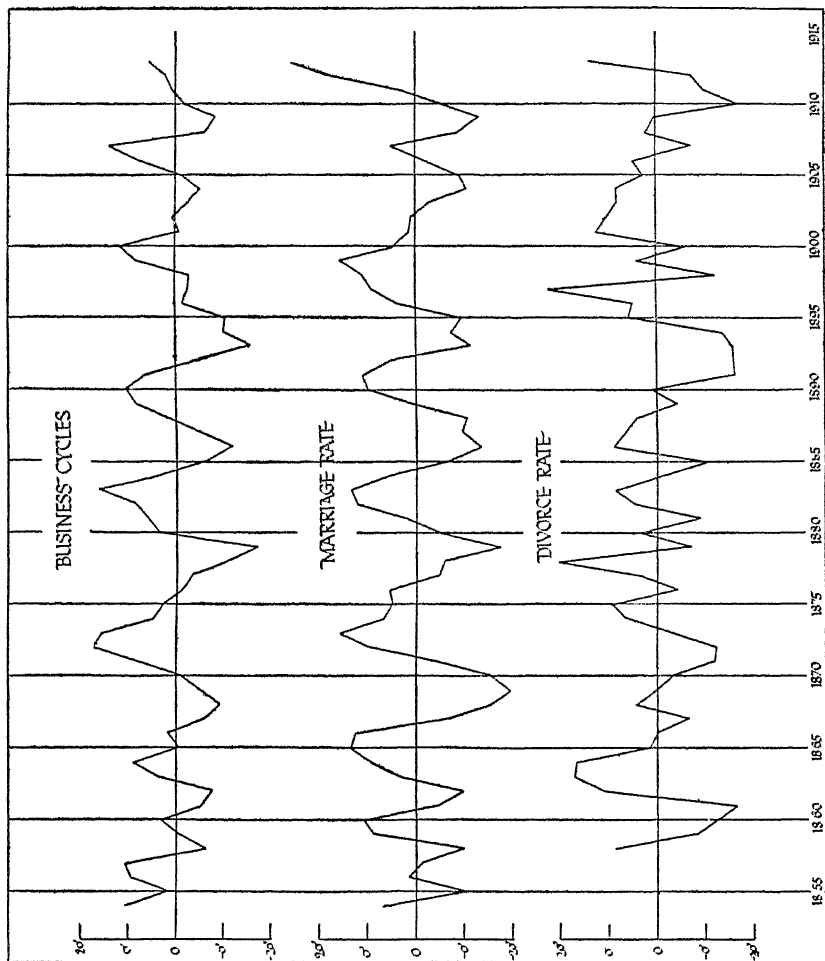


CHART II.

CHAPTER III

MARRIAGES AND THE BUSINESS CYCLE

THE connexion between marriages and the business cycle has been considered so close that the marriage-rate has frequently been accepted as one of the indices of the prevailing prosperity or depression. Chart II shows clearly that the cyclical movement of the marriage-rate is in close and direct correspondence with the economic fluctuations. An examination of the two curves shows also that the correspondence is not invariable—that it is much closer for some cycles than for others, and that the correlation seems to be less pronounced in the last two decades.

A study of the correlation coefficients (Table I) shows that there is, on the whole, a high correlation between the business cycles and the marriage-rate. The correlation of annual items shows no evidence of a lag, i.e. the correlation coefficient is highest when synchronous items of the two series are correlated. For the whole period, 1854-1913, the correlation coefficient of $+ .67$ is significant of a close relationship. Dividing this period into three approximately equal sub-periods brings out some interesting tendencies. The

coefficient for the first sub-period, 1854-74, was slightly less than that for the whole period, + .64; for the second sub-period, 1875-94, it was very high indeed, + .84; and for the third sub-period, 1895-1913, the coefficient, + .57, was the lowest recorded, though still significant of a very close relationship. These correlation coefficients probably under-estimate the closeness of the relationship between the business cycle and the marriage-rate, that is to say, the two series frequently move in the same direction when one is positive and the other negative. Correlating the "first differences" of the cycles (i e. the difference between the first and second items, the second and third items, etc., of the one series with the corresponding differences of the second series) rather than the actual cycles shows the correspondence of direction to be greater than the correspondence of position.¹ Testing the series for a lag in the response of the marriage-rates to movements in the business cycle, it is apparent that this lag is not as great as a year, and that it tends to vary with different cycles. The correlation coefficient for the whole period with the marriage-rate lagging one year behind

¹ The coefficients of correlation by this method are .

1854-1913 $r = + .73 \pm .06$

1854-1874 $r = + .74 \pm .10$

1875-1894 $r = + .79 \pm .08$

1895-1913 $r = + .67 \pm .13$

Although the coefficients tend to be raised somewhat by this method, the same tendencies appear as when the actual cycles were correlated.

the business cycle is still moderately high, $+ \cdot 45$, but is considerably lower than that for synchronous items. For the first and second sub-periods, the coefficients for a lag of one year in the marriage-rate are also high, but lower than for synchronous items. For the second sub-period (1875-94), however, the co-efficient for synchronous items is $+ \cdot 84$, and that for a lag of a year is $+ \cdot 79$ —such a small difference indicates a considerable lag, though not of a whole year, in the response of the marriage-rate during this period. For the last sub-period, however, there is evidence of no connexion whatsoever between the business cycle and the marriage-rate of the following year, the co-efficient of correlation ($+ \cdot 09$) being considerably less than its standard deviation (± 23). It is evident that the response of the marriage-rate to the business cycle occurs almost immediately for most cycles. The lag, when it occurs, is so irregular that it cannot be isolated even by dividing into sub-periods.

The differential lag may possibly be due to the effect of postponements of marriage during depression and their cumulations in prosperity,¹ for prosperity is not only favourable to marriage for those who have just reached a marriageable age and state, but it also makes possible a large

¹ Yule advances the hypothesis of postponement as affecting the correlation of the marriage-rate with economic events. *Op cit.*

number of marriages which had been planned and postponed in the preceding depression. The cumulative effect of these postponements, and the differential degree of accumulation may account, in part at least, for the differential lag.

The generally close connexion of the marriage-rate and the business cycle has an obvious explanation. The wage-earning capacity of a man who marries must usually be extended immediately to support a wife, and must be large enough to cover the possibility of further dependents. In a highly industrialized country, a depression in industry causes widespread unemployment for a large class of workmen, and diminished wages for many others. The present income of a wage-earner tends to be cut to a point where an extra immediate burden would be regarded as unwise, and his prospective income is so uncertain as to make the assumption of possible future burdens appear disastrous. The tendency to wait for better financial prospects before marrying would obviously explain the diminution of marriages in a period of depression. Similarly, the higher earning capacity and general optimism as to the future prevailing in times of prosperity would tend to encourage marriage. The closeness of response of the marriage-rate to business conditions would seem to be dependent on several factors :

(1) The degree of industrialization. An agri-

cultural population is not influenced to any great extent by business cycles, but would be dependent on the adequacy or deficiency of the harvest, the price of corn, etc. On the whole, the more highly industrialized the community, the greater the expectation of the influence of the business cycle upon the marriage-rate.

(2) The degree to which marriage would actually entail extra burdens to the husband. If the wife were employed in a gainful occupation, for instance, she might be a financial asset rather than a burden. Furthermore, if the necessary knowledge of contraceptives were available and accepted, the increase of the family could be postponed until better times.

(3) The degree to which extremes of poverty and riches prevail. People living near the poverty level would probably not be greatly affected by cycles of prosperity and depression. Their condition tends to be but little improved in times of prosperity, and one degree worse does not hold many extra burdens. Prudence is an unaccustomed attitude, for their general condition seems to be beyond the possibility of improvement. Hence, persons at the lower extremes of society probably marry without much relation to present or prospective business conditions. Similarly, the very rich would probably not be affected to a degree to prevent marriage during a business depression.

(4) The degree to which a community has provided means of alleviating distress due to a business depression, such as social insurance, etc.

The factors suggest a possible explanation of the differential relationship between the business cycle and the marriage-rate from 1854-1913. The fact that the correspondence was less close from 1854-74 than from 1875-94 may have been due partly to the fact that agriculture was relatively much more important during the earlier than the later period, and has been diminishing steadily as a factor of importance. In 1851, 50% of the population lived in rural districts, in 1871, 38%, and in 1891, only 28%. The proportion of males engaged in agriculture has also diminished greatly. It is evident that the period saw a lessening of the dependence of the English population upon agriculture, and a consequent increase of their dependence upon industry. If this factor is of prime importance, the progressive industrialization during these decades may well explain the increase in correspondence between the marriage-rate and business conditions during the two decades 1874-1895. Furthermore, this factor would not have had an increasing effect from 1895-1913, since the country was almost as highly industrialized by that time as it is now. The rural population had diminished to 23% by 1901, and fell only 1% further to 22% by 1911. The rapidity of change

in the earlier decades, and its decided slowing down in the later decades might, therefore, explain why the agricultural situation would be an important item for the earlier years of this study, why it diminished as an influence later, and why the explanation of the diminution of correspondence between the marriage-rate and the business cycle for the later decades should be sought in the development of other factors.

The next problem to consider is whether there has been any real diminution in the burdens entailed by the husband. It is difficult to obtain reliable statistical evidence, but existing comparative statistics of women employed in industry do not give any evidence of an upward swing in the proportion of women employed. Probably, therefore, any lessening of the burden of marriage has not come through more widespread economic independence of women. A factor which undoubtedly enters, however, is the development of effective methods of birth control, and the gradual diffusion of the knowledge of these methods. Thus, it is possible to enter marriage upon the assumption that children need result only at the will of the parents. The steady fall of the birth-rate since about 1876 is considered evidence of the diffusion of knowledge and increasing use of means of preventing conception. It seems undeniable that this would remove one of the economic obstacles to marriage,

and that, therefore, the marriage-rate might be expected to respond somewhat less closely to the business cycle in later years. The coefficients of correlation show that the correlation has tended to be weaker for the later period.

The development of forms of social insurance has probably been effective in diminishing the ill-effects of depressions. Unemployment insurance, however, has probably had no real influence in lessening the response of the marriage-rate to the business cycle.

The fact that the marriage-rate is subject to such wide fluctuations, corresponding closely to the phases of the business cycle, suggests the possible correspondence between certain other phenomena and the business cycle. If marriages decrease during a depression, extra-legal unions might be expected to increase. It is difficult, however, to find any index of the incidence of such unions. One indication would be the number of illegitimate births. This factor is discussed in the following chapter. Another index would be the amount of prostitution. Unfortunately for statistical analysis, there is no registration of prostitutes in England. There is, therefore, no adequate index of the amount of prostitution, its general trend, or its annual fluctuations. Prostitution is, however, a punishable offence under English law, and therefore, the number of prosecutions for prostitution might be expected

to show the fluctuations in prostitution. Such a series was examined for correspondence with the marriage-rate and the business cycles. The coefficients of correlation are large enough to attain significance. Contrary to expectation, however, the correlation with the business cycle is positive, i.e. there are more prostitutes prosecuted in times of prosperity than in depressions. There seems to be a differential lag. For the whole period, 1857-1913, the highest of the rather low coefficients, $+ .22$, was obtained for synchronous items. In the first of the sub-periods, 1857-74, there was also no lag, a strong positive correlation, $+ .56$, existing between synchronous items. In the second sub-period 1875-94 the coefficients do not attain significance for synchronous items, or for items lagging one year behind the business cycle, but are quite large, $+ .46$ and $+ .48$, for the correlation of items lagging two and three years respectively. For the last sub-period, 1895-1913, the highest coefficient is for synchronous items, but negative, $- .49$. A high positive correlation, $+ .44$, results if the items are taken for a lag of three years. When the correlation coefficients change signs during the period under consideration, it is very difficult to interpret their meaning. The change of correlation from direct to inverse, suggests that the data may be subject to considerable error, or incomparable over time, for it is extremely improbable that an excess of

prostitution should in the earlier decades be strongly associated with prosperity and in the last decades equally strongly associated with depression. It is probable that "prosecutions for prostitution" is not a good index of the actual degree or of the fluctuations in prostitution. A factor which complicates and tends to invalidate the figures as such an index is the fact that a large number of the prosecutions are for "prostitutes behaving in a riotous manner". Disorderly prostitutes would generally be drunken prostitutes, and thus the prosecutions for prostitution might largely be influenced by fluctuations in alcoholic consumption, and hence tend to be positively correlated with the business cycle. (See Chapter VII.) It is apparent, therefore, that, although this series of figures relating to prostitution shows a positive correlation with the business cycle, it is impossible to make any generalizations from the results shown here as to the actual fluctuations in prostitution.

To some extent the influences which lead to an increase in marriages in times of prosperity might also be expected to lead to an increase in divorce. A lessening of economic pressure gives freer play to emotional responses. Many people may desire to marry in times of business depression, but the economic situation may inhibit that desire. Similarly, many people may desire to break off a marriage during a business depression, but the

economic pressure and the necessity of working together probably inhibits this desire also until release is made possible through the greater economic freedom of prosperity. Contrary to expectation, the correlation of the divorce-rate of England and Wales shows absolutely no connexion between the business cycle and divorce. As a careful examination of Chart II will show, the high points on the divorce-rate curve are associated indiscriminately with high and low points on the curve of business cycles. The correlation coefficients for the whole period 1858-1913 are 0 for synchronous items, and also for items lagging one, two, and three years behind the business cycle. The correlation coefficients for the sub-periods rarely attain significance. A lag of three years for the period, 1858-75 gives a coefficient of $+ .26$, but in the following period, 1876-94, the only coefficients which attain significance are negative, $- .33$ and $- .36$ for lags of two and three years respectively. The other coefficients are all less than their standard deviations, and hence probably of no significance whatsoever. The only conclusion that can be drawn from a study of these figures is that in England and Wales there is no connexion between the business cycle and fluctuations in the divorce-rate. This lack of correlation between business conditions and divorce in England may be due to the fact that divorce is relatively

infrequent, and hence restricted to a small class of the population. It is possible that this class may not be affected by the business cycle to such an extent that a business depression would prevent divorce procedure. The lengthy proceeding in England might also be a factor obscuring the economic influence. This does not seem to be the case, however, as no significant coefficients were obtained between the business cycle and the divorce-rate with a lag as great as three years. Furthermore, the fluctuations in the annual series for "petitions filed for dissolution of marriage" were found, by inspection, to synchronize with fluctuations in the series for "decrees granted for dissolution of marriage".

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TABLE 1

COEFFICIENTS OF CORRELATION

(with standard deviations of coefficients)

BRITISH BUSINESS CYCLES AS STANDARD

(A) Marriage-rates as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|---|---|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = + 67 \pm 07$ | $r = + 45 \pm 10$ | | |
| 1854-1874 | $r = + 64 \pm 13$ | $r = + 43 \pm 18$ | | |
| 1875-1894 | $r = + 84 \pm 07$ | $r = + 79 \pm 09$ | | |
| 1895-1913 | $r = + 57 \pm 15$ | $r = + 09 \pm 23$ | | |

(B) Divorce-rates as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1858-1913 | $r = - 02 \pm 13$ | $r = 0$ | $r = - 01 \pm 14$ | $r = 0$ |
| 1858-1875 | $r = - 12 \pm 23$ | $r = - 08 \pm 23$ | $r = + 19 \pm 23$ | $r = + 26 \pm 22$ |
| 1876-1894 | $r = + 13 \pm 23$ | $r = - 17 \pm 22$ | $r = - 33 \pm 21$ | $r = - 36 \pm 20$ |
| 1895-1913 | $r = - 18 \pm 22$ | $r = - 12 \pm 23$ | $r = + 21 \pm 23$ | $r = + 16 \pm 24$ |

(C) Prosecutions for Prostitution as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = + 22 \pm 13$ | $r = + 18 \pm 13$ | $r = + 17 \pm 13$ | $r = + 15 \pm 13$ |
| 1857-1874 | $r = + 56 \pm 16$ | $r = + 41 \pm 20$ | $r = - 12 \pm 23$ | $r = - 29 \pm 22$ |
| 1875-1894 | $r = + 17 \pm 22$ | $r = + 17 \pm 22$ | $r = + 46 \pm 18$ | $r = + 48 \pm 17$ |
| 1895-1913 | $r = - 49 \pm 18$ | $r = - 37 \pm 20$ | $r = - 20 \pm 23$ | $r = + 44 \pm 20$ |

BIRTHS AND THE BUSINESS CYCLE

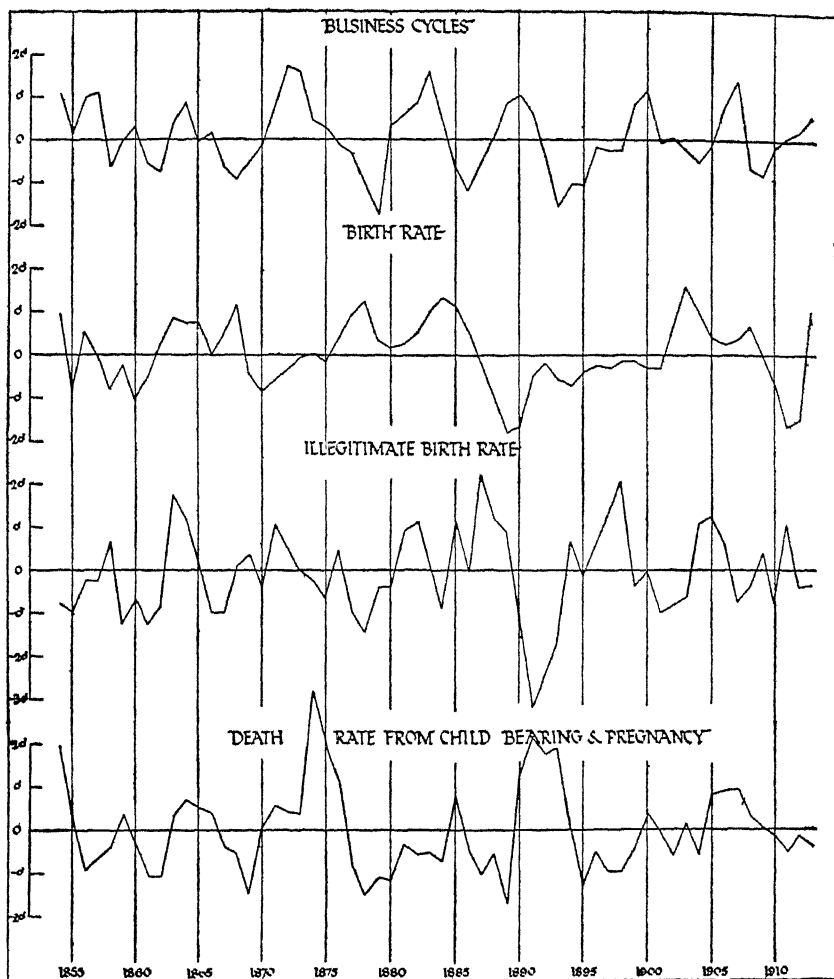


CHART III.

CHAPTER IV

BIRTHS AND THE BUSINESS CYCLE

FLUCTUATIONS in the birth-rate tend to reflect the business cycle also, but with a considerable lag, as is evident from Chart III. For the whole period, 1854-1913, low but significant correlation coefficients, $+0.29$ and $+0.30$ are obtained for a lag of two years and three years respectively. No significant coefficients are obtained for the sub-period, 1854-74. Coefficients of $+0.35$ and $+0.34$ were obtained for the sub-period, 1875-94 for lags of two and three years, and for the sub-period 1895-1913 the maximum coefficient of $+0.64$ resulted with a lag of three years, and a high coefficient $+0.42$ with a lag of two years.¹

These coefficients suggest several interesting points : (1) The birth-rate shows a distinct tendency

The birth-rate tends towards a two-year periodicity, in addition to the wider cyclical movement. This periodicity does not occur regularly throughout the whole series of years, but occurs in patches, the patches being separated by series of years, in which the periodicity is not evident.

Correction for this periodicity was made by taking the means of adjacent years and reading a new value for each year affected by the periodicity. Years which were corrected by this method were .—1858-9, 1868-75, 1879-81, 1884-99, 1905-8

This periodicity has been noted by Yule (loc cit) who does not arrive at any conclusion as to its cause. He suggests that a possible factor may be that the average period between births is two years.

It is probable that this periodicity is due to some non-economic cause, and it was therefore thought desirable to eliminate it from the data

to reflect the fluctuations of the business cycle. How far this tendency is due to the close connexion between the marriage-rate and the birth-rate, or how far it is directly due to the business cycle is difficult to estimate. One point in evidence for a direct influence of the business cycle upon the birth-rate is the fact that, whereas the correlation between the marriage-rate and the business cycle has become weaker in the last two decades of this study, the correlation between the birth-rate and the business cycle has tended to become steadily stronger, and attains its maximum during the period 1895-1913.

(2) The birth-rate shows no correlation with the synchronous items of the business cycle, and lags after the business cycle by about two or three years. There could, of course, be little real connexion between the economic conditions of any year and the birth-rate of the same year, for it is probable that the response to economic depression takes the form of prevention of conception rather than abortion, infanticide, etc. Therefore, a lag of at least a year would be expected. The lag is probably prolonged further because of the influence of marriage-rate fluctuations upon the birth-rate. If the birth-rate responded immediately to an increase or decrease in the marriage-rate, that is, if a large number of conceptions occurred shortly after marriage, a lag of one year would be expected in the response of the birth-rate to the marriage-rate and hence also to the

business cycle. It seems, however, that the birth-rate does not respond immediately to the marriage-rate. Yule found the following correlations¹ between the deviations of birth-rates and marriage-rates from eleven year moving averages for 1850-96 :—

Birth-rate lagging one year + .35, two years + .48; three years + .42.

Thus, the maximum lag of the birth-rate behind the marriage-rate is about two years,² and this would tend to prolong the response of the birth-rate to the business cycle.

The correspondence between the business cycle and the marriage-rate is much closer than that between the business cycle and the birth-rate. If the marriage-rate correlation with the business cycle be considered high, then the birth-rate correlation must be considered low to moderate. The birth-rate correlation is high for the last decade, but the fact that so few years could be used (1895-1913) makes the coefficient less significant than if a longer series were available. It should be noted, however, that the connexion between the birth-rate and the business cycle has become steadily stronger. This fact becomes even more significant if we consider the tendency of the marriage-rate to reflect the business cycles less closely in the later decades. It suggests the interesting hypothesis that, whereas

¹ Yule, *op cit*, p. 123.

² March (*loc. cit*, p. 274) found the following correlations for the same data, 1851-1901 — Birth-rate lagging one year + .28; two years + .34, three years + .33.

a business depression formerly led to "prudential restraint" through abstention from marriage, it now leads to a more widespread and deliberate use of birth control. It seems reasonable to expect that the birth-rate would respond more sensitively to the business cycle as it becomes subject more to human volition.

The direct response of the birth-rate to the business cycle offers a partial explanation of the cause of the lag in the birth-rate. The effects of unemployment and financial stresses accumulated during a depression are not immediately relieved when prosperity is indicated by the business barometer. Wages lag behind commodity prices in a business revival¹ It probably takes a considerable period to recover from the losses of a depression, hence there might be unwillingness to assume further responsibilities by increasing the size of the family until prosperity is fairly well established.

The response of the birth-rate to the business cycle, then, is probably partly direct, through the differential conscious control of births in prosperity and depression, and partly indirect through a reflection of the fluctuations in the marriage-rate.

The illegitimate birth-rate, on the whole, shows a closer correlation with the business cycle than does the birth-rate. The correlation is, however, inverse, i.e. illegitimate births increase in a depression, and

¹ Mitchell, *op cit*, p 465, and pp 130-9

decrease in prosperity. The correlation is moderate throughout. For the whole period 1854-1913, the maximum correlation occurs with two years' lag, $-.39$, and the coefficient is almost as high, $-.37$, with three years' lag. From 1854-74, the coefficients were $-.37$ with two years' lag, and $-.33$ with three years' lag, increasing in 1875-84 to $-.43$ with two years' lag, and $-.38$ with three years' lag. The lag changes in 1895-1913, the highest coefficient being $-.43$ for one year's lag, and $-.39$ and $-.42$ for two and three years' lags respectively.

The degree of correlation seems to have changed very little during the whole period, increasing slightly towards the later years.

The inverse correlation of illegitimacy with the business cycle is probably due to the restriction of the marriage-rate in times of depression. It would be expected that the same forces which have served to strengthen the positive correlation of the total birth-rate with the business cycle would have weakened the inverse correlation of illegitimacy and the business cycle. The illegitimate birth-rate does not seem to have been affected to the same extent as the birth-rate by the diffusion of birth-control information. The steadily downward trend of the total birth-rate since about 1878 is usually explained as a direct result of the publicity given to birth control at that time and its subsequent further diffusion. The illegitimate birth-rate shows no

.

correspondingly steady downward trend, but is best represented by a double parabolic movement, actually increasing from 1876-83, then falling from 1883-1902 and rising again from 1892-1913. The rate is approximately the same in 1890 and in 1913. The conclusion arises that illegitimacy is fairly closely connected with economic fluctuations, and that the correlation has tended to increase somewhat from about 1875.

Deaths from childbirth are supposed to be more frequent where conditions of poverty prevail. The correlation coefficients between the death-rate from child-bearing and pregnancy (non-septic), however, shows a direct relationship with moderately high coefficients throughout. For the whole period, 1854-1913, the maximum coefficient comes with a lag of two years, $+0.46$, a lag of one year giving $+0.42$. For 1854-74, lags of two and three years give equal maxima, $+0.45$, whereas synchronous items have a coefficient of $+0.43$. From 1875-94 the maximum is definitely for a lag of two years, the coefficient being $+0.56$, and $+0.42$ results for a lag of a year. For the last sub-period, 1895-1913, the maximum is reached with synchronous items, $+0.50$, and falls to $+0.34$ with a year's lag. These results are difficult to interpret. The mere fact of a maximum in the birth-rate two or three years after maxima of prosperity explains why there might be an increase in deaths from childbirth at

similar periods. But the higher incomes and greater material well-being at such a time ought to make possible conditions of better nourishment, medical care, etc., which would tend to decrease this death-rate. It may be that the greater employment of women in times of prosperity makes them more liable to conditions causing mortality in childbirth. Whether the excessive alcoholism of prosperity affects this phenomenon is doubtful. These and other similar problems¹ must be the subjects of medical research, and the speculations of the sociologist do not throw any light upon them.

¹ Deaths from premature birth show also a direct relationship with the business cycle, although the coefficients of correlation do not attain the same degree of significance

For the whole period, 1854-1913, the maximum coefficient is +.22 for a lag of three years. For 1854-74, the maximum is also for a lag of three years, +.35, and for 1875-94, +.24 for a lag of two years. For the final sub-period, 1895-1913, the coefficients are negative throughout, and insignificant except for synchronous items, -.38. This change of sign in the coefficients arouses doubt as to the validity of the data, and suggests that the correlation may be accidental

Newsholme (*Vital Statistics*, London, 1923) calls attention to the relative stability of premature birth death-rates *within* any district, but points out the differential rates as between districts and classes. Thus, in 1911, the death-rate from premature birth was 20.0 in county boroughs, 17.1 in rural districts, 13.8 for upper and middle classes, and 20.3 for miners. These facts seem to suggest that premature births are to some extent a function of the environment of the mother, but the correlations worked out as above do not show that the changing environment in the different phases of the business cycle have any marked influence.

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TABLE 2.
COEFFICIENTS OF CORRELATION
(with standard deviations of coefficients)
BRITISH BUSINESS CYCLES AS STANDARD

(A) *Birth-rates as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = -.07 \pm 13$ | $r = +.07 \pm 13$ | $r = +.29 \pm 12$ | $r = +.30 \pm 12$ |
| 1854-1874 | $r = +.04 \pm 22$ | $r = -.14 \pm 21$ | $r = +.09 \pm 22$ | $r = +.03 \pm 22$ |
| 1875-1894 | $r = -.17 \pm 22$ | $r = +.17 \pm 22$ | $r = +.35 \pm 20$ | $r = +.34 \pm 20$ |
| 1895-1913 | $r = -.03 \pm 23$ | $r = +.16 \pm 23$ | $r = +.42 \pm 20$ | $r = +.64 \pm 15$ |

(B) *Illegitimate Birth-rates as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = +.07 \pm 13$ | $r = -.26 \pm 12$ | $r = -.39 \pm 11$ | $r = -.37 \pm 12$ |
| 1854-1874 | $r = +.26 \pm 20$ | $r = -.04 \pm 22$ | $r = -.37 \pm 19$ | $r = -.33 \pm 20$ |
| 1875-1894 | $r = +.10 \pm 22$ | $r = -.32 \pm 20$ | $r = -.43 \pm 18$ | $r = -.38 \pm 19$ |
| 1895-1913 | $r = -.25 \pm 22$ | $r = -.43 \pm 19$ | $r = -.39 \pm 21$ | $r = -.42 \pm 21$ |

(C) *Death-rates from Childbearing and Pregnancy as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = +.24 \pm 12$ | $r = +.42 \pm 11$ | $r = +.46 \pm 10$ | $r = +.30 \pm 12$ |
| 1854-1874 | $r = +.43 \pm 18$ | $r = +.45 \pm 17$ | $r = +.45 \pm 17$ | $r = +.25 \pm 21$ |
| 1875-1894 | $r = 0$ | $r = +.42 \pm 18$ | $r = +.56 \pm 15$ | $r = +.38 \pm 19$ |
| 1895-1913 | $r = +.50 \pm 17$ | $r = +.34 \pm 21$ | $r = +.06 \pm 24$ | |

(D) *Death-rates from Premature Birth as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = 0$ | $r = +.19 \pm 13$ | $r = +.20 \pm 13$ | $r = +.22 \pm 13$ |
| 1854-1874 | $r = +.14 \pm 21$ | $r = +.27 \pm 20$ | $r = +.24 \pm 21$ | $r = +.35 \pm 19$ |
| 1875-1894 | $r = 0$ | $r = +.16 \pm 22$ | $r = +.24 \pm 21$ | $r = +.19 \pm 22$ |
| 1895-1913 | $r = -.38 \pm 20$ | $r = -.10 \pm 23$ | $r = 0$ | $r = -.10 \pm 24$ |

DEATHS AND THE BUSINESS CYCLE

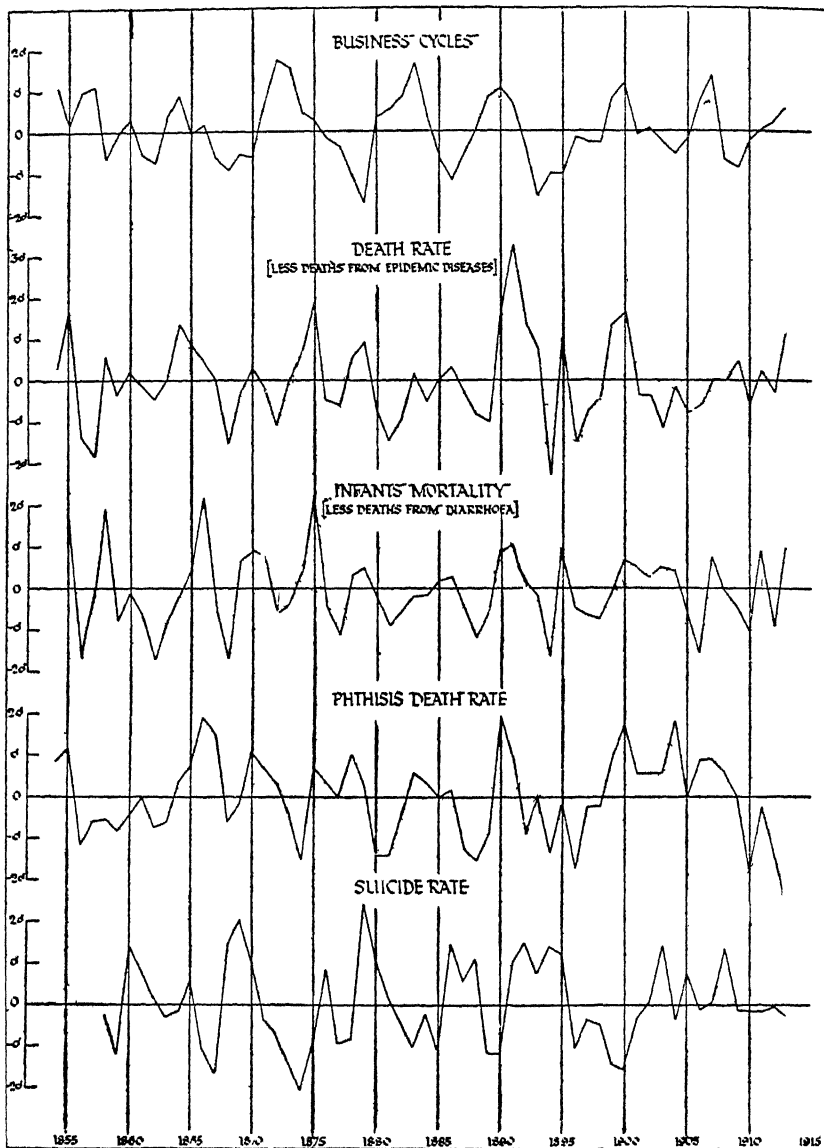


CHART IV.

CHAPTER V

DEATHS AND THE BUSINESS CYCLE

THE death-rate is a phenomenon which fluctuates from a variety of causes. A very cold winter, or a very hot or rainy summer, might cause a tremendous increase in the death-rate, as would also the prevalence of an epidemic. Likewise, it might be supposed that the business cycle would influence the death-rate, that the very young, the very old, and people of weak constitutions would readily succumb to the hardships of a business depression, and that the greater material comforts and increased ability to employ medical attention in times of prosperity would lower the death-rate. In order to measure the economic influence, it is necessary to remove the causes of certain of the irregular fluctuations. Therefore, the chief epidemic diseases were subtracted from the total deaths from all causes before the rates were computed. The corrected death-rate, then, excludes deaths from smallpox, measles, scarlet fever, diphtheria, croup, whooping cough, typhus, enteric fever, pyrexia, diarrhœa, dysentery, and cholera. These diseases caused nearly one-quarter of the total deaths 1850-60, but in the later years, only about one-tenth of the total deaths. These epidemic diseases tend to move in cycles of

their own,¹ and to obscure the effects of the business cycle. Epidemic diseases are also subject to wide and irregular fluctuations, and have a multiplicity of little-understood causes. Furthermore, these diseases have shown a great diminution in their mortality following each Sanitary Act, e g of 1866, 1868, 1872, the Consolidation Act of 1875, etc. Therefore, although it is possible that epidemics may the more readily break out in a time of business depression, and have more fatal consequences, the other influences bearing upon them were so complex, so difficult to isolate, and frequently unknown, that it was decided to eliminate the deaths from these diseases from the total death-rate. The death-rate, thus corrected, would be expected to show an inverse relationship with the business cycle, because of the generally recognized differential mortality in rich and poor districts.² The coefficients of correlation,

Newsholme says "Cyclical influences alter the total death-rate by causing a large excess of one or more epidemic diseases. It has been usually assumed that these cycles are related to the accumulation during epidemic intervals of persons unprotected by previous attack. Even in measles this explanation is not adequate, and in such diseases as smallpox, influenza, etc., other unknown or little understood factors must be invoked to explain their cyclical changes in prevalence and sometimes also in fatality." *Op. cit.*, p 266.

² Dr. T. H. C. Stevenson gives comparative figures of the "Incidence of Mortality upon the Rich and Poor Districts of Paris and London" (*J.R.S.S.*, Jan., 1921)

The Paris figures are taken from a study of Hirsh. Using the number of domestic servants as a measure of wealth in London, and returns of a special tax in Paris, the following death rates occur —

| I. <i>Wealthy dists.</i> | | II. <i>Well-to-do dists.</i> | | III. <i>Poor dists.</i> | | IV. <i>Miserable.</i> | |
|--------------------------|------|------------------------------|------|-------------------------|------|-----------------------|------|
| Paris | 11 0 | | 13 0 | | 16 9 | | 22 4 |
| London | 13 2 | | 12 2 | | 14 1 | | 17 1 |

The excess of poorest over richest in Paris was 104 per cent, in London, 30 per cent.

however, show a positive connexion between the business cycle and the corrected death-rate. The correlation coefficients are not very high, but range from low to moderate. For the whole period, 1854-1913, the maximum coefficient, $+0.30$, is obtained with death-rates lagging a year behind the business cycle. The coefficient for two years' lag is also significant, $+0.24$. For the sub-period, 1854-74, the maximum, $+0.26$, occurs with a year's lag; for 1875-94, $+0.39$ is the coefficient for two years' lag, and $+0.32$ for a year's lag; for 1895-1913, $+0.35$ results with a year's lag, and $+0.28$ with synchronous items. Thus, the significant coefficients tend to be constantly positive, low, or moderate in value, and to show a definite lag of one or two years.

It would be rash to read too much into these figures, because of the fact that the death-rate is influenced by such complex causes. It is, however, quite evident that a business depression does not tend to cause an excess of mortality, and that, if it actually causes any increase in mortality, other factors, operating in times of prosperity, tend to have much more serious results. It is interesting to note that this correlation between an increased mortality and prosperity has remained practically constant throughout the whole period considered. That this connexion is not a direct result of prosperous conditions seems probable, and it may be that some non-economic circumstance,

synchronizing frequently with prosperity, is at the root of the explanation. Two phenomena of prosperity which might cause a rise in the death-rate, are, first, the excessive alcoholism (Chapter VII), and, secondly, the very high emigration which has tended to occur in times of prosperity (Chapter IX), and which might raise the death-rate by removing the young and healthy.

There were also difficulties in the correlation of infant mortality and the business cycle. A large part of infant mortality is due to diarrhoeal diseases, which vary directly with the amount of rainfall, the temperature, etc. The infant mortality rate was, therefore, corrected by subtracting infant deaths from diarrhoea. The correlation coefficients were again positive.¹ For the whole period, 1855-1913, the ² maximum correlation was $+0.28$ with a year's lag, and $+0.26$ with two years' lag. For the period 1855-74 there was a maximum $+0.29$ with a two years' lag, and $+0.23$ resulted with a year's lag. For 1875-94 the coefficients were $+0.28$ with two years' lag and $+0.25$ with a year's lag, and for 1895-1913 the maximum, $+0.48$, occurred with a year's lag. These results are again contrary to expectation,

¹ A positive correlation with the business cycle might be expected, because the general death-rate and infant death-rate are highly correlated. Yule (*Introduction to the Theory of Statistics*, London, 1922, p. 198) found a coefficient of $+0.77$ between general and infant deaths, 1838-1904

² The two-year periodicity observed in the birth-rate also appears in the infant mortality rates and was eliminated from the same years and in the same way as for the birth-rate (see note 1, p. 97).

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because of the connexion between infant mortality and poverty in general.¹ There are, however, certain conditions existing in prosperity which might account for part of this increase in infantile mortality.

In the first place, although no exact information is at hand, it is probable that more women are employed in times of prosperity than during a depression. There seems to be a connexion between high infant mortality and employment of women in factories.² The industrial employment of women might be expected to lead to a diminution of breast-feeding, which is closely connected with high infant

¹ Stevenson (op cit) cites the following relationship of infant mortality to poverty Rates of infant mortality found in the following district —

| I. <i>Wealthy.</i> | II. <i>Well-to-do.</i> | III. <i>Poor</i> | IV. <i>Miserable.</i> |
|--------------------|------------------------|------------------|-----------------------|
| Paris 51 | 69 | 107 | 151 |
| London 100 | 94 | 103 | 128 |

The excess of the poorest over the richest was 200 per cent for Paris and 28 per cent for London.

² Dr. George Reid, Medical Officer of Health for Staffordshire, divided the towns of Staffordshire with strictly comparable sanitary conditions into groups according to the percentage of women employed in industry, and found the following relation, 1881-90

| <i>Groups of Towns.</i> | <i>Rate of Infant Mortality.</i> |
|---------------------------------|----------------------------------|
| 1 Many women employed | 195 |
| 2. Fewer women employed | 166 |
| 3 Practically no women employed | 152 |

(*Provincial Medical Journal*, Oct, 1892) Dr. Hugh Jones, "Perils and Protections of Infant Life," *J R S S*, March, 1894, constructed a similar table for the whole of England, 1871-80.

| <i>Groups of Towns.</i> | <i>Rate of Infant Mortality.</i> |
|-------------------------------|----------------------------------|
| 1. 15% or more women workers | 175 |
| 2 10%-15% women workers | 171 |
| 3 Less than 10% women workers | 154 |

Miss Collett ("Extent and Effect of Industrial Employment of Women," *J R S S*, 1898, pp. 219-60) criticizes these tables, and claims that the determining factor is the living conditions of the women, not their employment.

mortality. In one inquiry in the United States,¹ concerned with more than 20,000 infants, it was found that the mortality among artificially fed infants was 3.9 times as high as among breast-fed. Industrial employment of women of the poorer classes would also tend to cause the neglect of their children.

The excessive infant mortality in times of prosperity might also be due in part to the increase of alcoholism at these times (see Chapter VII). The drunkenness of parents is the direct cause of many deaths of infants. There is a close connexion between "over-laying" as a cause of infant deaths, and drunkenness, as is evidenced by the weekly coincidence of arrests for drunkenness and deaths of infants from this cause.² Hence, the increased drunkenness in prosperous times might be a factor in the high infant death-rates.

Further research is needed to isolate the various factors entering into the fluctuations in both the general and the infant death-rate.

Tuberculosis is also supposed to be more frequent among the poorer sections of the community, and might, therefore, be expected to fluctuate in inverse relationship with the business cycle. The only index

¹ Investigation by Woodbury (*Amer Journl. Hygiene*, vol 11, Nov 1922), quoted by Newsholme, *op cit*, p 365.

² Dr Hugh Jones, *op. cit*, found that almost one-third of the deaths of infants due to suffocation are referred to Saturday night, and that somewhat more than one-third of the weekly apprehensions for drunkenness occur on Saturday night

of the ravages of the disease extending over a period of years is the death-rate from the several forms of tuberculosis.¹ I have taken the death-rate from phthisis as being the most satisfactory of the available series. The correlation tends to be direct, i.e. phthisis deaths occur more frequently in times of prosperity than in depression. For the whole period, 1854-1913, the maximum correlation, $+0.27$, results with a year's lag. For the earlier years, 1854-74, however, the correlation is inverse, the maximum, -0.29 , occurring with a lag of two years. For 1875-94 the maximum, $+0.54$, occurs with a lag of two years, with $+0.49$ for a lag of a year; and in 1895-1913, the maximum, $+0.35$, occurs with a lag of a year. Thus the coefficients attain real significance in the last two sub-periods, but the change of the coefficients from negative to positive throws some doubt upon the validity of the series.

It is questionable, of course, whether the use of the death-rate from phthisis means much in this connexion, since it probably gives a very poor indication of the differential incidence of the disease during prosperity and depression. It is possible that persons who contract the disease in a depression do not die until prosperity. The one or two years'

¹ The absolute connexion between poverty and mortality from tuberculosis is indicated by Stevenson's tables. Mortality from tuberculosis in the following districts

| | I. <i>Wealthy</i> | II. <i>Well-to-do</i> | III. <i>Poor</i> | IV. <i>Miserable</i> |
|--------|-------------------|-----------------------|------------------|----------------------|
| Paris | 1 48 | 2 68 | 4 31 | 5 86 |
| London | 1 39 | 1 70 | 1 70 | 2 21 |

lag, however, makes even this assumption doubtful. Newsholme¹ emphasizes the complexity of the phenomenon, and points out that at the same time there may be factors favouring and opposing a reduction of the disease, and that it is difficult to isolate these several factors. The chief factors he mentions as favouring a reduction of the disease are improved and improving hygienic conditions, improved standard of life (especially in regard to nutrition), and the development of medical treatment. The chief factors opposing reduction are the general urbanization, replacement of outdoor by indoor occupations, and crowding in houses. It is difficult to see how any of these factors would operate very differently in depression than in prosperity, since each of them probably represents a continuous development. It is conceivable that migrations from country to towns would occur more frequently in times of prosperity than of depression, and that there would be a greater tendency to overcrowding at such times.

The suicide-rate shows a strong inverse correlation with synchronous items of the business cycle, as is quite evident from Chart IV. The coefficient of correlation for the whole period, 1858-1913, is $-.50$ for synchronous items, and $-.47$ for a lag of one year. For the first sub-period, the maximum is obtained with a lag of two years, $-.59$, but the corre-

¹ Op. cit., pp 461-2.

lation is high for synchronous items, $-.41$, and for a lag of a year, $-.52$. For the second sub-period, 1876-94, there is a double maximum, the correlation coefficient being $-.53$ both for synchronous items and for a lag of a year, but for 1895-1913, the maximum is definitely for synchronous items, $-.53$, the coefficient for a lag of a year being only $-.21$.

It is not surprising that the greatest number of suicides occurs during business depression. The high negative correlation seems to indicate that the economic factor is predominant in causing the fluctuations in the suicide-rate. Unemployment and pauperism are probably the most serious factors bringing about an increase in suicide for the working class. Enforced liquidation and business failure are probably important factors for the upper classes. It is also possible that the restriction of the marriage-rate and the increase of illegitimacy during a depression lead to a tendency to suicide. But it is surprising that there is so short a lag in the suicide-rates. One would expect suicide to be generally associated with the last stages of a depression—an escape to be resorted to only when every other effort had failed. This seems to be the case for the first years in this study, when the maximum occurs with a two years' lag, but in the later years the closest correspondence is with synchronous items or items showing a lag of not more than a year.

TABLE 3

COEFFICIENTS OF CORRELATION

(with standard deviations of coefficients)

BRITISH BUSINESS CYCLES AS STANDARD

(A) *Death-rates (less deaths from epidemic diseases) as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = + 04 \pm 13$ | $r = + 31 \pm 12$ | $r = + 24 \pm 12$ | $r = + 06 \pm 13$ |
| 1854-1874 | $r = - 10 \pm 22$ | $r = + 26 \pm 20$ | $r = + 14 \pm 21$ | $r = + 24 \pm 21$ |
| 1875-1894 | $r = + 02 \pm 22$ | $r = + 32 \pm 20$ | $r = + 39 \pm 19$ | |
| 1895-1913 | $r = + 28 \pm 21$ | $r = + 35 \pm 21$ | $r = + 10 \pm 24$ | |

(B) *Infant Mortality (less infant deaths from diarrhoea) as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1855-1913 | $r = + 04 \pm 13$ | $r = + 28 \pm 12$ | $r = + 26 \pm 12$ | $r = + 08 \pm 13$ |
| 1855-1874 | $r = - 04 \pm 22$ | $r = + 23 \pm 21$ | $r = + 29 \pm 21$ | $r = + 11 \pm 22$ |
| 1875-1894 | $r = + 09 \pm 22$ | $r = + 25 \pm 21$ | $r = + 28 \pm 21$ | $r = + 14 \pm 22$ |
| 1895-1913 | $r = + 10 \pm 23$ | $r = + 48 \pm 18$ | $r = + 20 \pm 23$ | |

(C) *Phthisis Death-rates as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|--|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = + 10 \pm 13$ | $r = + 28 \pm 12$ | $r = + 17 \pm 13$ | $r = - 16 \pm 21$ $r = + 24 \pm 21$ |
| 1854-1874 | $r = - 03 \pm 22$ | $r = - 05 \pm 22$ | $r = - 29 \pm 20$ | |
| 1875-1894 | $r = + 09 \pm 22$ | $r = + 49 \pm 17$ | $r = + 54 \pm 16$ | |
| 1895-1913 | $r = + 21 \pm 22$ | $r = + 35 \pm 21$ | $r = + 15 \pm 24$ | |

(D) *Suicide-rates as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|---|
| | 0 | 1 | 2 | 3 |
| 1858-1913 | $r = - 50 \pm 10$ | $r = - 47 \pm 11$ | $r = - 26 \pm 13$ | |
| 1858-1875 | $r = - 41 \pm 20$ | $r = - 52 \pm 17$ | $r = - 59 \pm 15$ | |
| 1876-1894 | $r = - 53 \pm 17$ | $r = - 53 \pm 16$ | $r = - 17 \pm 22$ | |
| 1895-1913 | $r = - 53 \pm 17$ | $r = - 21 \pm 22$ | $r = + 23 \pm 23$ | |

PAUPERISM AND THE BUSINESS CYCLE

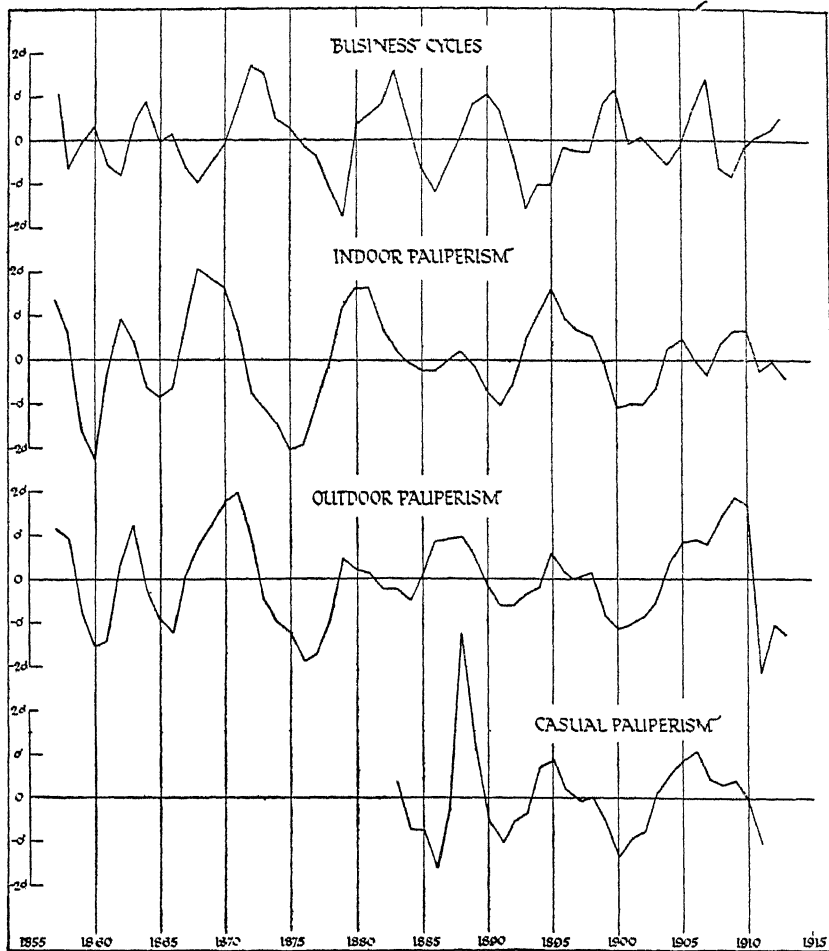


CHART V.

CHAPTER VI

PAUPERISM AND THE BUSINESS CYCLE

THE relative amount of pauperism at any time has been considered a belated index of the preceding prosperity or depression. Several series representing the annual fluctuations in pauperism were correlated with the business cycle, to see to what degree the influence of the business cycle was reflected in these series.

The best series for such correlations is undoubtedly the amount of indoor pauperism at any time, i.e. the number of paupers relieved in the work-houses, excluding casuals and the insane. This series has not been subject to violent fluctuations due to changing administrative policy, etc., and tends to show the cyclical movement uncomplicated by extraneous factors. The correlation is, of course, inverse—excessive pauperism occurring during business depressions. The connexion between the business cycle and indoor pauperism has been relatively constant and high throughout the period investigated. There is a differential lag of one, two, or three years. The coefficients for the whole period, 1857-1913, are $-.52$ for one year's lag, and $-.51$ for two years' lag. For the sub-period

1857-74, the maximum is reached with two years' lag, $-.54$, but there are also high coefficients for a year's lag, $-.51$, and three years' lag, $-.51$. The maximum is again reached with a two years' lag in 1875-94, the coefficients being $-.63$ for two years' lag, and $-.52$ for a year's lag. For the last decades, 1895-1913, however, the maximum is reached with synchronous items, $-.61$, and is almost as high, $-.59$, for a lag one of year.

The connexion between the business cycle and pauperism is an obvious one. With each depression in trade the army of paupers is swelled, and with the return of prosperity many of these recruits are again absorbed into industry. The considerable lag between the business cycle and indoor pauperism probably occurs because of the struggles of the poverty-stricken unemployed in the earlier stages of a depression to avoid sinking to the level of paupers. As conditions become worse, and immediate employment is unattainable, recourse to the workhouse or starvation may become the alternatives, especially if the wage-earner has dependents. That suicide is an occasional alternate escape has been indicated in Chapter V: the question of resort to crime as another alternative will be discussed in Chapter VIII.

Outdoor pauperism, i.e. the relief of paupers in their own homes, is more frequent than indoor pauperism, although it has tended to decrease

rapidly during the period of this study. This has been due largely to the policy of discouraging the grants of outdoor-relief to able-bodied paupers, and the application of a "workhouse" or "labour" test to such persons seeking relief. The administrative policy in regard to outdoor relief has been subject to changes, and, therefore, the series is not as reliable as the series for indoor pauperism in indicating the uncomplicated relationship of pauperism to the business cycle. The correlation coefficients tend, on the whole, to be lower, but still significant. For the whole period, 1857-1913, a maximum, $- .32$, is obtained with a year's lag, and $- .30$ for two years' lag. For the first sub-period, 1857-74, the maximum, $- .62$, occurs with two years' lag, and $- .61$, with three years' lag. For the next sub-period, 1875-94, the lag of two years likewise gives the maximum coefficient, $- .48$, and a lag of a year gives $- .37$. In this series, also, the lag tends to disappear in the last decades, and the highest coefficient for 1895-1913, $- .38$, occurs with synchronous items, falls to $- .21$ for a lag of a year, and becomes positive if a further lag is assumed.

The coefficients for outdoor pauperism show that it fluctuates subject to the same influences as indoor pauperism, and confirm the connexion between the business cycle and pauperism in general. The length of the lag indicates that the resort to

outdoor relief by those impoverished by the business cycle has also tended to occur some time after the depth of the business depression has been reached. This is probably due to the fact that accumulated savings and other sources of income may carry the unemployed through the earlier stages of the depression. The accumulated savings are eventually dissipated, however, and as unemployment becomes worse, outdoor relief is applied for.

The absence of any lag in responding to the business cycle in the data from 1895-1913 for both outdoor and indoor pauperism is difficult to understand. Whether the agitation for a complete revision of the Poor Law in the early part of the twentieth century, the appointment of the Poor Law Commission in 1905, and the publicity given to the subsequent reports of the commission have had any widespread influence in reducing this lag is difficult to determine. Changes in administrative policy have occurred during these decades, and, by making relief more adequate and easier to obtain, may have helped to reduce the lag. The increased facilities of social insurance may have removed from the necessity of applying for relief a part of those who would have held off as long as possible in any case. The promptness of the response may, therefore, be due to the fact that those who apply for relief now are more frequently unemployed persons with no accumulated savings, perhaps

engaged ordinarily in casual labour, whom the beginning of a depression leaves without any means of livelihood.

Fluctuations in casual pauperism also correspond to the business cycle. The most satisfactory series is that showing for each year the average number of casual paupers relieved in the casual wards of the metropolis each Friday during that year. A comparable series can only be secured from 1883 to 1911, because of important changes in law and administration in both 1882 and 1911. The correlation between casual pauperism and the business cycle tends to be similar to that between other forms of pauperism and the business cycle. The coefficients are, for the period, 1883-1911, — .34 for a year's lag, a maximum of — .46 for two years' lag, and — .29 for three years' lag. These coefficients are interesting because of the light they throw on the general assumption that "tramps", and other casual paupers, are unemployables. At any rate, it is evident that their ranks are greatly increased during a business depression and that many of them must obtain employment during prosperity.

These results show that the chief indices of pauperism reflect the fluctuations of the business cycle by increasing to a marked degree during depression, and decreasing as business conditions improve. This increase or decrease does not attain

a maximum or minimum at the trough or the peak of the business cycle, but follows with a varying lag, averaging about two years in the earlier years of the period. The lag seems to have disappeared or diminished greatly in the later years.

The significance of the connexion between the business cycle and pauperism arises from the fact that pauperism itself is both a symptom of misery and a cause of grave social consequences.

TABLE 4
COEFFICIENTS OF CORRELATION
(with standard deviations of coefficients)
BRITISH BUSINESS CYCLES AS STANDARD
(A) *Indoor Pauperism as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = -32 \pm 12$ | $r = -52 \pm 10$ | $r = -51 \pm 10$ | $r = -36 \pm 12$ |
| 1857-1874 | $r = -41 \pm 20$ | $r = -51 \pm 17$ | $r = -54 \pm 17$ | $r = -51 \pm 18$ |
| 1875-1894 | $r = -13 \pm 22$ | $r = -52 \pm 16$ | $r = -63 \pm 14$ | $r = -31 \pm 20$ |
| 1895-1913 | $r = -61 \pm 14$ | $r = -59 \pm 15$ | $r = -23 \pm 23$ | $r = -03 \pm 25$ |

(B) *Outdoor Pauperism as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = -11 \pm 13$ | $r = -32 \pm 12$ | $r = -30 \pm 12$ | $r = -15 \pm 13$ |
| 1857-1874 | $r = 0$ | $r = -39 \pm 20$ | $r = -62 \pm 14$ | $r = -61 \pm 15$ |
| 1875-1894 | $r = 0$ | $r = -37 \pm 19$ | $r = -48 \pm 17$ | $r = -14 \pm 22$ |
| 1895-1913 | $r = -38 \pm 20$ | $r = -21 \pm 23$ | $r = +19 \pm 23$ | $r = +36 \pm 21$ |

(C) *Casual Pauperism as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1883-1911 | $r = +02 \pm 19$ | $r = -34 \pm 17$ | $r = -46 \pm 15$ | $r = -29 \pm 18$ |

ALCOHOLISM AND THE BUSINESS CYCLE

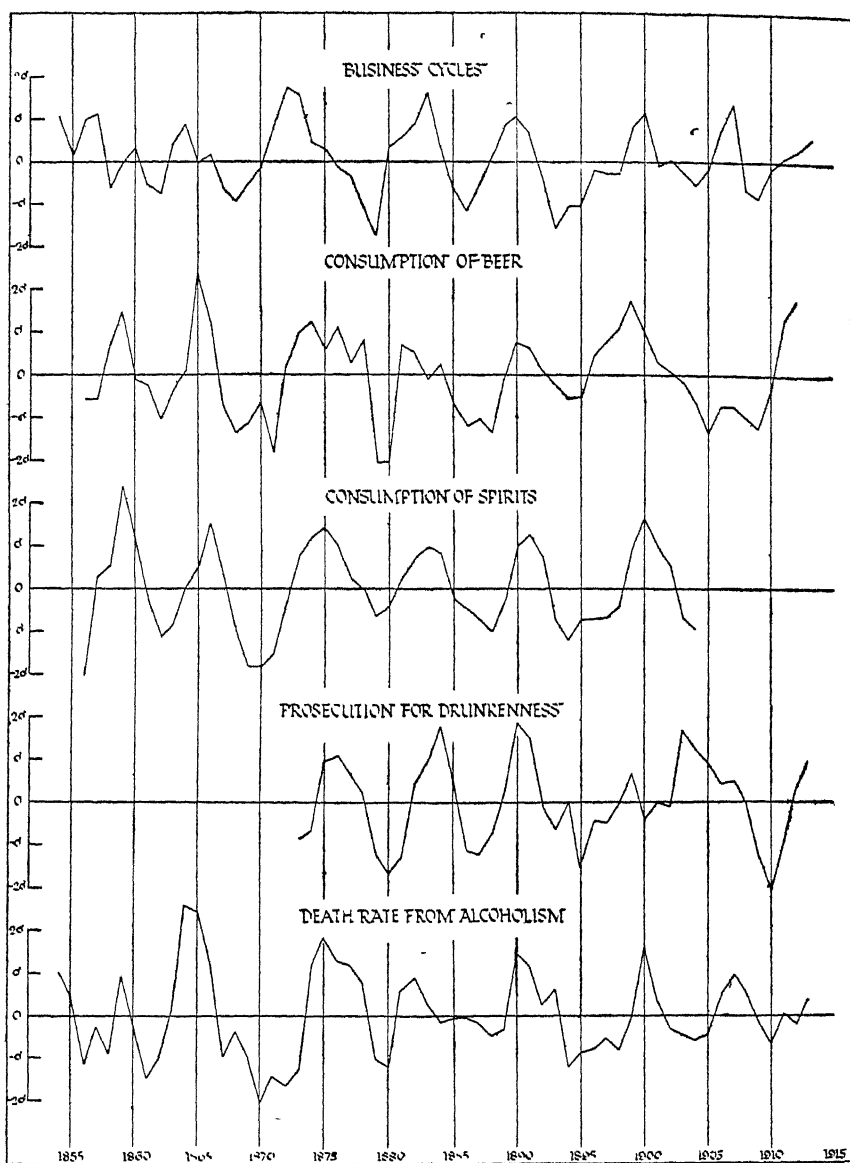


CHART VI.

CHAPTER VII

ALCOHOLISM AND THE BUSINESS CYCLE

EXCESSIVE alcoholism tends to be largely a phenomenon of "good times". Several series representing fluctuations in alcoholic consumption and the results of this differential consumption as evidenced by prosecutions for drunkenness and deaths from alcoholism were correlated with the business cycle.

The fluctuations in per capita consumption of beer show a fairly high positive correlation with the business cycle, but the maximum in consumption is reached a year or more after the peak of prosperity. For the whole period, 1856-1912, the highest coefficient of correlation was $+ .45$ with a year's lag, and $+ .30$ for synchronous items. For the earlier years, the correlation seems to have been much higher, reaching a maximum of $+ .64$ with a lag of two years, and $+ .53$ with a lag of one year, during 1856-74; and a maximum of $+ .69$ with a year's lag (and $+ .41$ for synchronous items) in 1875-94. The later years show the highest positive connexion for synchronous items, $+ .34$, and a zero or negative correlation if a lag is assumed.

This increase in the consumption of beer during prosperity is probably a result of the increase of general consuming power coincident with full employment and high wages. The lag in consumption is probably caused by the lag in wages. There are probably also psychological factors involved in this increase of drinking. The general good feeling and optimism generated by prosperity lead to an increase in conviviality. Likewise, the strain of overtime, and the general pressure of work require the relaxation obtainable through alcoholic stimulation. Consumption of beer does not lead to severe drunkenness, and is probably merely an indication of the greater well-being and good spirits prevailing during prosperity.

Consumption of spirits, on the other hand, has frequently serious consequences. Its correlation with the business cycle is high, and tends to be much closer than the consumption of beer. For the period 1856-1904¹ the maximum correlation, + .60, is reached with a year's lag, and is almost as high, + .56, with two years' lag. For the first half of this period, 1856-1879, the highest coefficient, + .62, was obtained with two years' lag, high coefficients resulting also with a year's lag, + .45, and three years' lag, + .47. For the second half of the period, 1880-1904, very high coefficients

¹ Figures for 1905-13 are not comparable with the previous years because of changes in Licensing Acts, etc.

resulted, the maximum, $+ .81$, with a year's lag, and $+ .72$ for synchronous items.

These coefficients suggest that the consumption of spirits is much more in the nature of a luxury than the consumption of beer, although the latter fluctuates also in relation to business conditions. Consumption of spirits is considered as a much more abnormal phenomenon than the consumption of beer, since the former tends towards an escape from reality through drunkenness, whereas the latter is in the nature of an almost necessary addition to the ordinary worker's diet.

The close connexion between the consumption of spirits and prosperity offers an interesting suggestion as to the relative effect of psychological and economic factors upon such a phenomenon. Theoretically, the greatest psychological need for drunkenness would arise at the time of greatest misery. But, however sordid the surroundings, and however intense the desire to escape from them, the ability to make such an escape is a function of the ability to purchase. The ability to purchase varies directly with the degree of prosperity and acts as a limiting factor to the consumption of spirits (or beer) during a business depression. Furthermore, once prosperity obtains, the condition of those who suffered from the preceding depression is not improved at a stroke. Escape from the reality of miserable surroundings, through drink,

is often easier than a definite attempt to reconstruct and improve those surroundings.

Naturally, not all consumption of spirits should be regarded as an attempt to make a psychological escape—nor are spirits always taken in such excess as to produce drunkenness. A large part of the increase in consumption of spirits during prosperity may merely represent a moderate increase in the consumption of luxuries by those whose ability to purchase has increased.

That it leads frequently to drunkenness, however, is shown by the fact that prosecutions for drunkenness show a high positive correlation with the business cycle. The coefficient of correlation for the period, 1873-1913,¹ was a maximum, + .54, for a year's lag, and high, + .45, for two years' lag. For the first half of the period, 1873-94, the maximum also occurred for a year's lag, + .68, and two years lag gives + .67. For the latter half of the period the correlation is much lower, the maximum coefficient, + .32, occurring for synchronous items, and + .25 for a lag of a year. It is doubtful whether the connexion has really lessened to this degree, since the figures for the later years do not form a strictly comparable series with those for the earlier years, because of changes in the administration of the law resulting from the Inebriates Act of 1898-9, and its amendment in

¹ Owing to changes in the law, earlier years are not comparable.

1901. The fluctuations clearly indicate, however, a positive connexion with the business cycle, varying from high in the earlier years to moderately low in the later years.

More serious than drunkenness are deaths resulting directly from excessive alcoholism (death-rate from intemperance and delirium tremens). The connexion of this series with the business cycle is positive, and the coefficients of correlation vary from moderate to high. For the whole period, 1854-1913, the maximum coefficient, $+ .38$, is obtained with a lag of a year, and $+ .29$ with a lag of two years. The first part of this period, 1854-74, shows, also, a moderate degree of correlation, the highest coefficient being $+ .36$, with three years' lag and $+ .34$ with two years' lag. The coefficients are high for the latter part of the period, however, a maximum of $+ .66$ occurring from 1875-94, for a lag of one year, and a maximum of $+ .73$ for a year's lag, and $+ .72$ for synchronous items from 1895-1913. This close connexion between deaths from alcoholism and the business cycle is rather surprising and seems to show that alcoholic excesses take their toll very quickly, for the lag is about the same as is that for the consumption of spirits and the business cycle. Such deaths are probably caused by the deterioration of the system by previous continued intemperance, and the sudden excesses of prosperity are possibly

TABLE 5

COEFFICIENT OF CORRELATION
(with standard deviations of coefficients)

BRITISH BUSINESS CYCLES AS STANDARD

(A) *Per Capita Consumption of Beer as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|--------------------|--------------------|
| | 0 | 1 | 2 | 3 |
| 1856-1912 | $r = + 30 \pm .12$ | $r = + .45 \pm 11$ | $r = + .23 \pm 13$ | $r = - 12 \pm .13$ |
| 1856-1874 | $r = + .17 \pm 22$ | $r = + 53 \pm 17$ | $r = + .64 \pm 14$ | $r = + 24 \pm .22$ |
| 1875-1894 | $r = + .41 \pm 19$ | $r = + .69 \pm 12$ | $r = + 20 \pm 21$ | $r = - 32 \pm .20$ |
| 1895-1912 | $r = + .34 \pm 21$ | $r = 0$ | $r = - 38 \pm 21$ | $r = - .44 \pm 21$ |

(B) *Per Capita Consumption of Spirits as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|---------------------|---------------------|
| | 0 | 1 | 2 | 3 |
| 1856-1904 | $r = + .36 \pm .12$ | $r = + 60 \pm .09$ | $r = + 56 \pm 10$ | $r = + 32 \pm 13$ |
| 1856-1879 | $r = + 11 \pm .20$ | $r = + .45 \pm 16$ | $r = + 62 \pm .13$ | $r = + .47 \pm .16$ |
| 1880-1904 | $r = + 72 \pm 10$ | $r = + 81 \pm .07$ | $r = + .49 \pm .16$ | $r = + .13 \pm 21$ |

(C) *Prosecutions for Drunkenness as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|---------------------|---------------------|
| | 0 | 1 | 2 | 3 |
| 1873-1913 | $r = + 33 \pm .14$ | $r = + 54 \pm .11$ | $r = + .45 \pm .13$ | $r = + 04 \pm 16$ |
| 1873-1894 | $r = + 34 \pm .19$ | $r = + 68 \pm .12$ | $r = + 67 \pm 12$ | $r = + .15 \pm .21$ |
| 1895-1913 | $r = + 32 \pm 21$ | $r = + .25 \pm 22$ | $r = 0$ | |

(D) *Death-rates from Alcoholism as correlative*

| | Years that correlative lags behind standard | | | |
|-----------|---|---------------------|---------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1854-1913 | $r = + 22 \pm .12$ | $r = + .38 \pm 11$ | $r = + 29 \pm 12$ | $r = + 36 \pm 19$ |
| 1854-1874 | $r = + 07 \pm 22$ | $r = + 18 \pm 21$ | $r = + 34 \pm 19$ | |
| 1875-1894 | $r = + 32 \pm .20$ | $r = + .66 \pm .13$ | $r = + .45 \pm .18$ | |
| 1895-1913 | $r = + .72 \pm .11$ | $r = + 73 \pm 11$ | $r = + 06 \pm 24$ | |

CRIME AND THE BUSINESS CYCLE

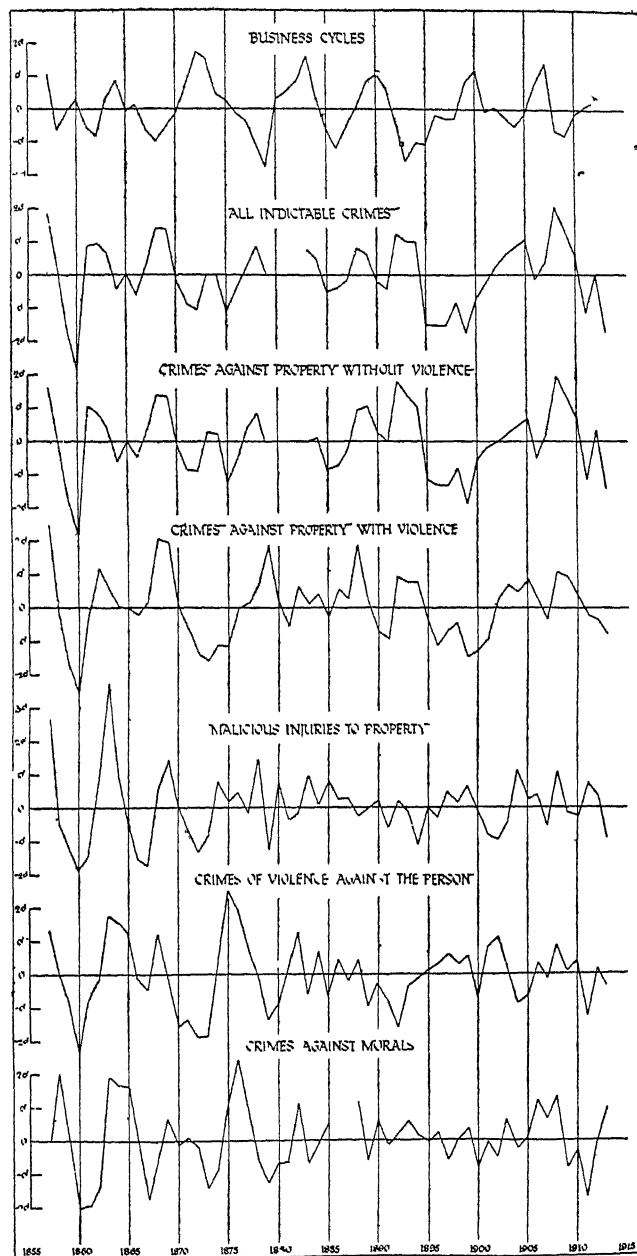


CHART VII.

CHAPTER VIII

CRIME AND THE BUSINESS CYCLE

CRIME is probably the most complex of the social phenomena dealt with in this study, for the factors leading to crime are many and complicated. Criminologists and sociologists have divided into camps, each emphasizing some one factor as being the ultimate cause of crime. There are some who claim that crime is almost exclusively a function of the prevailing economic system; others claim that it is determined by environment, but that economic influences are a minor part of that environment. Still others emphasize a biological predisposition to crime as the determining factor. Whatever the ultimate cause of crime, it is quite apparent, from observation of any series representing an index of crime from year to year, that it is subject to fairly wide fluctuations, and tends to increase and decrease in oscillations. It is the purpose of this chapter to see to what degree these "cycles" of crime correspond to business cycles, and to test the various forms of crime for evidence of such a response to the conditions of economic prosperity and depression.

The first index of crime tested for a relationship with the business cycle was the series representing the number of persons for trial before the Assizes and Quarter Sessions, and Courts of Summary Jurisdiction for "All Indictable Crimes". Unfortunately, this series is not strictly comparable over the whole period because of the passage of the Summary Jurisdiction Act of 1879, which, by making procedure in criminal cases simpler and cheaper, led to a sudden increase in the number of prosecutions for those crimes to which it applied. The years 1880-2 (see Chart VIII) were, therefore, omitted from the correlations. The coefficients of correlation do not show a very close or significant correlation between "All Indictable Crimes" and the business cycle. For the period, 1857-1913, the only coefficient attaining significance is that for synchronous items, $-.25$. For the first sub-period, 1857-74, the highest correlation is also for synchronous items, $-.32$. For the next two sub-periods, however, although the highest *negative* coefficient is obtained in both cases from synchronous items, such coefficients do not attain the significance of positive coefficients resulting with a lag of two years. For the years 1875-94, $r = -.18 \pm .23$ for synchronous items and $+.28 \pm .22$ for items lagging two years behind the business cycle, neither of which coefficients can be considered really significant. For the years 1895-1913, $r = -.27 \pm .21$ for

synchronous items and $+51 \pm 18$ for a lag of two years. These coefficients make it impossible to assume on their basis any close connexion, either inverse or direct, between crime in general and the business cycle.

The complexity of the phenomenon suggests, however, that correlation between such an index and the business cycle might be misleading. "All Indictable Crimes" includes crimes of violence against property and the person, crimes against morals, larcenies, malicious injuries to property, offences against the currency, etc. It is quite conceivable that the fluctuations in these various forms of crime may have different causes—that some may have no connexion at all with the business cycle, others may fluctuate directly with it and still others be in inverse relationship to it. It is important, therefore, to test, by correlation, several of the subdivisions of "All Indictable Crimes".

By far the most numerically important subdivision found in the annual tables of Judicial Statistics is Class III,¹ "Offences against Property without violence," including 80–90 per cent of the total indictable crimes. These offences are chiefly larcenies, in regard to which there would be a strong

¹ The specific offences included in this class are —

| | |
|------------------------------|--------------------------|
| Larceny of Horses and Cattle | Embezzlement |
| Larceny from the Person | Larceny of Post Letters. |
| Larceny in a House. | Other Larcenies. |
| Larceny by a Servant. | Frauds. |
| | Receiving Stolen Goods. |
| | Offences in Bankruptcy. |

a priori supposition of an inverse correlation with the business cycle. The coefficients are not high, however. The maximum for the whole period, 1857-1913 (omitting, as above, 1880-2) is $-.25$ for synchronous items. For the years, 1857-74, $r = -.31$ for synchronous items. The maximum for 1875-94 is also for synchronous items, but is not significant, $-.19 \pm .23$. For the final years, 1895-1913, there is the same disconcerting relationship as observed in the series for all indictable crimes: a barely significant negative coefficient, $-.26 \pm .21$ for synchronous items, and an undoubtedly significant positive coefficient, $+.53 \pm .18$ for items lagging two years.

These discrepancies suggest that, although there is slight evidence of inverse correlation between the business cycle and larcenies, the series used in this study does not show that correlation to be either strong or constant. It is probable that the changes in criminal procedure and law may have caused counter fluctuations which obscure the fluctuations due to economic causes. This series is not sufficiently reliable to base any definite conclusions on the results shown here.

Class II¹ of the criminal statistics, "Offences

¹ Class II includes —

Sacrilege.

Burglary.

House- and Shop-breaking, etc

Robbery.

Extortion.

against property with violence," has not, on the whole, been greatly affected by changes of law or administration. It would, therefore, be expected that if any relationship with the business cycle exists, it would show itself in the correlation coefficients. There is, indeed, a fairly strong inverse correlation with the business cycle. For the whole period, 1857-1913, the maximum coefficient, $-.44$ occurred with synchronous items, and a moderate coefficient, $-.37$, with items lagging one year. For the earlier years, 1857-74, the maximum, $-.51$ occurred with items lagging one year, the coefficient for synchronous items being $-.39$, and for items lagging two years, $-.32$. For the next sub-period, 1875-94, the maximum, $-.51$, occurs with synchronous items, and the coefficient for a lag of a year is $-.39$. For the later years, 1895-1913, the maximum, $-.49$, is also for synchronous items. The constancy of these coefficients, and the fact that they are always high enough to be significant, tends to show evidence of a real relationship between this class of crimes and the business cycle. Burglary, house- and shop-breaking, and robbery, comprising 95-99 per cent of this class, show a definite tendency to increase in a business depression and to decrease with prosperity.

Malicious injuries to property comprise Class IV.¹

¹ Class IV includes —

Arson
Killing and Maiming Cattle
Other Malicious Injuries

This class is small and not very important, but, since a large number of the prosecutions are supposed to arise as a result of drunkenness ("Other malicious injuries" are very often damage to public houses by drunken persons), it seemed that there might be a positive correlation with the business cycle, resulting from the positive correlation of the business cycle and other phenomena of alcoholism. The coefficients, however, are not at all significant (see Table 27), and tend to show that the fluctuations in malicious injuries to property have no real connexion with the business cycle. No significant coefficient is obtained when the items of the whole period, 1857-1913, are correlated with the business cycle. For the first and third subdivisions of this period there is slight evidence of an inverse correlation, but for the middle years there is equal evidence for a positive correlation. The maximum coefficients are: 1857-74, $r = -\cdot30$, with a lag of a year; 1875-94, $r = +\cdot21$, for synchronous items, and $+\cdot22$ for a lag of two years, 1895-1913, $r = -\cdot31$ for a lag of three years, $-\cdot22$ for a lag of two years, and $-\cdot20$ for synchronous items. In all cases the standard deviation of the maximum coefficient is almost as large as (or exceeds) the coefficient itself. It is apparent that this series representing malicious injuries to property has no connexion with the business cycle.

Crimes against the person might also be expected

to show a connexion with the business cycle. A large part of such crimes are crimes of violence, and frequently arise from drunken brawls (over half of the crimes of violence being malicious wounding and assault).¹ The coefficients of correlation show, however, little connexion with the business cycle. For the whole period, 1857-1913, the highest coefficient, + .15 for a lag of two years cannot be considered significant. For the first part of the period, 1857-74, coefficients of +.28 and +.38 result from a lag of two and three years respectively, but for the next years, 1875-94, the only significant coefficient, - .33, is obtained with a lag of three years. The coefficients become positive again for the last years, 1895-1913, attaining a maximum of +.40 for two years' lag. Although these coefficients of correlation show that there is more often a tendency for crimes of violence against the person to increase with prosperity and diminish with depression than for the converse to happen, they are neither large enough nor sufficiently constant to be evidence of a real connexion between the business cycle and such crimes.

¹ Crimes of Violence against the Person include subdivisions 1-10 in Class I —

Murder
 Attempt to Murder.
 Manslaughter
 Felonious Wounding
 Malicious Wounding (Misdemeanours).
 Assault.
 Intimidation and Molestation.

Most of the other crimes against the person are offences against morals.¹ Most of these offences would be expected to vary inversely with the marriage-rate, and hence also with the business cycle. This series was subjected to a sudden increase following the passage of the Criminal Law Amendment Act of 1885, hence the years 1886-7 were excluded from the correlations.

There is no significant coefficient of correlation for the whole period, 1857-1913, nor for the first sub-period, 1857-74. Barely significant coefficients result for the other two sub-periods, however. For 1875-94, a coefficient of $+ \cdot 27$ is obtained with a lag of two years, and for 1895-1913, $+ \cdot 31$ for a lag of a year. These coefficients are not high enough to give evidence of any causal connexion between business cycles and crimes against morals. They seem to point to a slight tendency for such crimes to increase in times of prosperity and decrease in times of depression, suggesting that they may be more often a phenomenon of alcoholism rather than of the restriction of the marriage-rate.

¹ Offences against morals include subdivisions 14-26 of Class I —

Unnatural offences

Attempts to commit unnatural offences, etc.

Rape and indecent assaults on females, etc.

Defilement of girls under 13

Defilement of girls under 16

Householder permitting defilement of girls.

Procuration.

Abduction

Bigamy

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TABLE 6

COEFFICIENTS OF CORRELATION

(with standard deviations of coefficients)

BRITISH BUSINESS CYCLES AS STANDARD

(A) Prosecutions for All Indictable Crimes as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = -25 \pm 13$ | $r = +09 \pm 14$ | $r = +18 \pm 13$ | $r = +15 \pm 14$ |
| 1857-1874 | $r = -32 \pm 21$ | $r = -16 \pm 23$ | $r = -11 \pm 23$ | $r = -27 \pm 22$ |
| 1875-1894 | $r = -18 \pm 23$ | $r = +05 \pm 24$ | $r = +28 \pm 22$ | $r = +39 \pm 21$ |
| 1895-1913 | $r = -27 \pm 21$ | $r = +21 \pm 23$ | $r = +51 \pm 18$ | $r = +40 \pm 21$ |

(B) Prosecutions for Crimes against Property without Violence as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = -25 \pm 13$ | $r = +02 \pm 14$ | $r = +16 \pm 14$ | $r = +07 \pm 14$ |
| 1857-1874 | $r = -31 \pm 21$ | $r = -08 \pm 23$ | $r = -06 \pm 24$ | $r = -26 \pm 22$ |
| 1875-1894 | $r = -19 \pm 23$ | $r = 0$ | $r = +18 \pm 23$ | $r = +20 \pm 23$ |
| 1895-1913 | $r = -26 \pm 21$ | $r = +24 \pm 22$ | $r = +52 \pm 18$ | $r = +37 \pm 22$ |

(C) Prosecutions for Crimes against Property with Violence as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|------------------|------------------|------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = -44 \pm 11$ | $r = -37 \pm 12$ | $r = +08 \pm 13$ | $r = +11 \pm 13$ |
| 1857-1874 | $r = -39 \pm 20$ | $r = -51 \pm 17$ | $r = -32 \pm 21$ | $r = -19 \pm 23$ |
| 1875-1894 | $r = -51 \pm 17$ | $r = -39 \pm 19$ | $r = 0$ | $r = +30 \pm 20$ |
| 1895-1913 | $r = -49 \pm 17$ | $r = -09 \pm 23$ | $r = +32 \pm 22$ | $r = +51 \pm 18$ |

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(D) Prosecutions for Malicious Injuries to Property as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|--------------------|--------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = +.04 \pm .13$ | $r = -.11 \pm .13$ | $r = -.06 \pm .13$ | $r = 0$ |
| 1857-1874 | $r = +.05 \pm .24$ | $r = -.30 \pm .21$ | $r = -.15 \pm .23$ | |
| 1875-1894 | $r = +.21 \pm .21$ | $r = +.18 \pm .22$ | $r = +.22 \pm .21$ | $r = +.18 \pm .22$ |
| 1895-1913 | $r = -.20 \pm .22$ | $r = -.03 \pm .24$ | $r = -.22 \pm .23$ | $r = -.31 \pm .23$ |

(E) Prosecutions for Crimes of Violence against the Person as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|--------------------|--------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = +.06 \pm .13$ | $r = +.04 \pm .13$ | $r = +.15 \pm .13$ | $r = +.13 \pm .13$ |
| 1857-1874 | $r = -.20 \pm .23$ | $r = -.06 \pm .24$ | $r = +.28 \pm .22$ | $r = +.38 \pm .20$ |
| 1875-1894 | $r = +.14 \pm .22$ | $r = +.14 \pm .22$ | $r = -.17 \pm .22$ | $r = -.33 \pm .20$ |
| 1895-1913 | $r = +.14 \pm .23$ | $r = +.15 \pm .23$ | $r = +.40 \pm .21$ | $r = +.26 \pm .23$ |

(F) Prosecutions for Crimes against Morals as correlative

| | Years that correlative lags behind standard | | | |
|-----------|---|--------------------|--------------------|--------------------|
| | 0 | 1 | 2 | 3 |
| 1857-1913 | $r = +.05 \pm .13$ | $r = +.11 \pm .14$ | $r = +.08 \pm .14$ | |
| 1857-1874 | $r = 0$ | $r = 0$ | $r = 0$ | $r = +.09 \pm .23$ |
| 1875-1894 | $r = 0$ | $r = +.19 \pm .23$ | $r = +.26 \pm .22$ | $r = 0$ |
| 1895-1913 | $r = +.18 \pm .22$ | $r = +.31 \pm .21$ | $r = +.08 \pm .23$ | |

EMIGRATION AND THE BUSINESS CYCLE

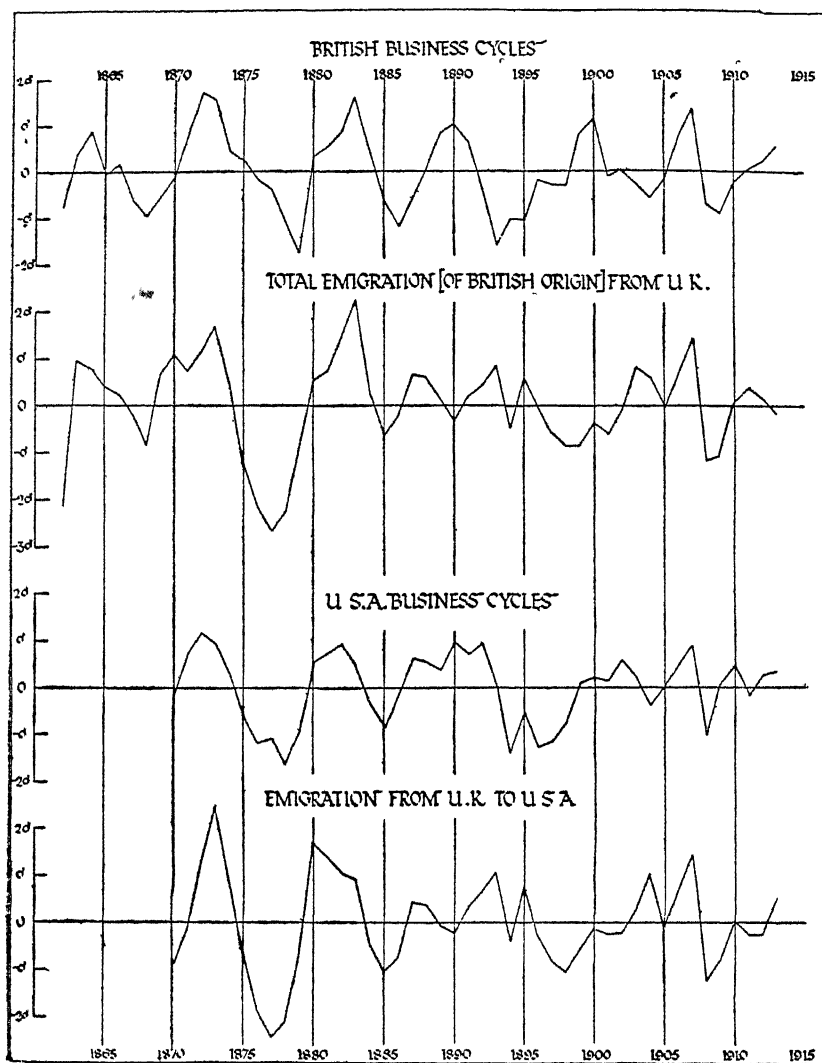


CHART VIII.

CHAPTER IX

EMIGRATION AND THE BUSINESS CYCLE

EMIGRATION is contrary to all of man's innate conservatism. He tends to become attached to his country, and, perhaps even more, to his locality. Habits formed as a reaction to a particular environment become a part of him, and it is not pleasant for him to contemplate breaking up these habits and reactions. It is often difficult to part with friends and family with common backgrounds, and to give up the old associations. There must be a strong stimulus to force a normal adult to leave his home and country and definitely settle down under new, and, so it often seems to him, barbarous conditions. This stimulus would seem to be twofold. On the one hand, present conditions in the home land would be expected to be rather bad, and the future outlook even worse, and conditions in the country to which he is emigrating would be considerably better than those at home, and future prospects even brighter. There would tend to be both a push and a pull.

A new country, with promising, unexplored natural resources and expanding industry would be expected, in general, to draw immigrants from a country whose resources were slight, or whose industries were not bringing rapidly increasing returns, or where unemployment was chronic.

Similarly, the business cycle, which tends, at one phase, to throw any country into this temporary state of paralysed industry and widespread unemployment, would be expected to create a temporary impulse to emigrate, and the coefficients of correlation between emigration and the business cycle should be negative. On the contrary, they tend to be positive and moderately high. The coefficients between total emigration from the United Kingdom, and the business cycle for the period 1862-1913, reaches a maximum of $+ \cdot 48$ with synchronous items. For the first half of the period, 1862-91, the correlation is $+ \cdot 63$ for synchronous items; but, for the second half, 1892-1913, the positive coefficients are not significant, and a maximum negative correlation of $- \cdot 40$ occurs with a lag of two years.

The explanation which suggests itself in regard to this remarkable correlation is that the pull may be a greater influence than the push, and that, if bad conditions in the home land synchronize with bad conditions abroad, there is no great temptation to exchange one uncertain but familiar environment for another uncertain and unfamiliar environment. To the extent, therefore, that the business cycle is international, a positive correlation of emigration to any country with its business cycle might be expected to reflect a positive correlation of emigration from another country with its business cycle. This hypothesis was tested by correlating the portion

of British emigration going to the U.S.A. (comprising more than a half of the total during most of this period) with the business cycle of the U.S.A.¹ A very high positive correlation resulted. For the period 1870-1913, the maximum $+·77$, occurred with synchronous items, and a high coefficient, $+·59$, with items lagging a year. For the first half of the period 1870-91, the maximum, $+·91$, resulted with synchronous items, and $+·71$ for a lag of a year. For the second half of the period, 1892-1913, the maximum $+·52$ was again for synchronous items, and $+·37$ for a lag of a year.

Further evidence for the assumption that conditions abroad are more important in causing emigration than conditions at home is found by correlating the British business cycles with the business cycles of the U.S.A. The coefficients were high and positive, but the connexion for the earlier half of the period was much closer than that for the latter half. For the whole period, 1870-1913, the coefficient of correlation of synchronous items was $+·65$. For the first half the coefficient was $+·74$, falling for the second half to $+·49$. Thus, it seems probable that good business conditions in the U.S.A. are a more potent cause of British emigration than are bad business conditions in Britain. The positive correlation of emigration with the British business cycle is in

¹ The indices for the business cycle of the United States are to be found in the paper appended to Chapter II, Ogburn and Thomas, *The Influence of the Business Cycle upon Certain Social Conditions*, p. 327.

part due to the close correlation of the American and British business cycles. A lessening of this correlation in the later decades, and the tendency to diversity in British and American conditions, also seems to lessen the positive correlation of British emigration and British business cycles.

Another factor which might cause a positive correlation between emigration and business conditions at home, however, is that the ability to meet the expenses of emigration is greater in times of prosperity than of depression, for, however great the stimulus to emigration, it cannot become an accomplished fact without a surplus of savings. It must be admitted that this necessity of saving to pay the costs of emigration would lead to the expectation of a lag in emigration, for savings tend to be dissipated during a depression. There is, however, no evidence of a lag. A further fact should be taken into account, that is, the composition of the emigrant population from Great Britain. The population emigrating to the United States is 20-30 per cent Irish, and the Irish would be least affected by the business cycle at home, because of the predominance of agriculture, and most affected by present conditions and future prospects abroad. Their savings would not have tended necessarily to diminish during a British business depression, hence, there would be no need to wait until prosperity had run its course at home before emigrating.

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TABLE 7

COEFFICIENTS OF CORRELATION

(with standard deviations of coefficients)

I

BRITISH BUSINESS CYCLES AS STANDARD

AND

TOTAL EMIGRANTS OF BRITISH ORIGIN FROM U K AS CORRELATIVE

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|-------------------|
| | 0 | 1 | 2 | 3 |
| 1862-1913 | $r = + 48 \pm 11$ | $r = + 14 \pm 14$ | $r = - 21 \pm 14$ | $r = - 30 \pm 13$ |
| 1862-1891 | $r = + 63 \pm 11$ | $r = + 19 \pm 18$ | $r = - 19 \pm 18$ | $r = - 46 \pm 14$ |
| 1892-1913 | $r = + 13 \pm 21$ | $r = - 08 \pm 22$ | $r = - 40 \pm 19$ | $r = - 03 \pm 23$ |

II

BUSINESS CYCLES—U S A.—AS STANDARD

AND

EMIGRANTS LEAVING U K. FOR U S A AS CORRELATIVE

| | Years that correlative lags behind standard | | | |
|-----------|---|-------------------|-------------------|---|
| | 0 | 1 | 2 | 3 |
| 1870-1913 | $r = + 77 \pm 06$ | $r = + 59 \pm 10$ | $r = + 17 \pm 15$ | |
| 1870-1891 | $r = + 91 \pm 04$ | $r = + 71 \pm 11$ | $r = + 18 \pm 21$ | |
| 1892-1913 | $r = + 52 \pm 16$ | $r = + 37 \pm 19$ | $r = + 13 \pm 22$ | |

III

CORRELATION COEFFICIENTS BETWEEN SYNCHRONOUS ITEMS OF

BRITISH BUSINESS CYCLES

AND

BUSINESS CYCLES—U S A

| | |
|-----------|-------------------|
| 1870-1913 | $r = + 65 \pm 09$ |
| 1870-1891 | $r = + 74 \pm 10$ |
| 1892-1913 | $r = + 49 \pm 16$ |

SUMMARY AND CONCLUSIONS

CHAPTER X

SUMMARY AND CONCLUSIONS

THE previous chapters have brought out certain significant points regarding the social aspects of British business cycles. The appended paper by Professor Ogburn and myself enables comparisons to be drawn between English and American conditions.

Marriage-rates in England and Wales were highly correlated with business conditions, increasing almost invariably, and in like degree, with increasing prosperity, and decreasing as depression in business sets in. Similar conditions were found in the United States where marriage-rates seem to follow even more closely the changes in business conditions than they do in England. The generally close connexions of the marriage-rate with the state of trade is probably due to the inability of the wage-earner to assume further responsibilities and burdens in a period of low wages and unemployment. An interesting tendency observed in the English data was a lessening of the correlation of marriages and the business cycle in the last two decades of the study (1895-1913). It is suggested that this may be due to the increasing use of contraceptives, which would tend to lessen the burdens of marriage. The somewhat closer connexions between marriages and business conditions in the United States may be due to the

greater severity of business depressions in the United States, the relatively bad condition of the unskilled worker, and the failure to provide suitable means of alleviating unemployment.

The restriction of the marriage-rate in times of depression would be thought to produce grave social effects. There are, however, few statistical indices either in England or the United States to show the incidence of these effects. Prosecutions for prostitution, England and Wales, tend to increase with prosperity, and decrease with depression. This is not considered a good index of the actual fluctuations in prostitution, but probably represents a phenomenon of alcoholism.

Divorce shows no connexion with the business cycle in England, but is highly correlated with business fluctuations in the United States. There, the greatest number of divorces occurs at the peak of prosperity—the fewest at the trough of depression. Divorce, there, seems to be greatly limited by the economic situation, to be a luxury for which the demand is elastic, and which tends only to be purchased when the income is sufficient. Divorce is, of course, much less frequent in England than in the United States. The average rate per 100,000 population for the United States, 1905–9, was 79, for England and Wales 1.8. Thus, divorce tends to be restricted to a small class of the population in England, and, since it is difficult and expensive to

obtain, may be restricted to a class which is not greatly affected by the business cycle. The high divorce-rate in the United States shows that divorce is probably not restricted to any one class of the population, but tends to prevail among many sections of the community which would be seriously affected by the business cycle.

Birth-rates show a moderately high correlation with the business cycle, both in England and the United States. The greatest number of births occurs in the United States approximately one year after the peak of prosperity, and in England the lag is approximately two years. The connexion between the birth-rate and business conditions is probably partly indirect (because the birth-rate is correlated with the marriage-rate)—and partly direct (through a deliberate restriction of births during periods of depression). The correlation between births and the business cycle in England is much stronger for the last years than for the earlier years of this study, suggesting that the effects of business depression may be tending towards a restriction of births rather than a restriction of marriages.

The illegitimate birth-rate in England usually moves in the opposite direction from business conditions (though the connexion is by no means invariable), illegitimacy showing a tendency to increase in business depressions and decrease when prosperity prevails. The correlation between

illegitimacy and the business cycle is slightly closer in the earlier years than is the connexion between the general birth-rate and business conditions. The increase of illegitimacy during a business depression is probably connected with the restriction of the marriage-rate, and the high marriage-rate during prosperity may be the cause of the decrease in illegitimacy.

Deaths from childbirth in England and Wales increase in prosperous times, possibly because of the increase of the birth-rate, and possibly, also, because of the greater employment of women.

The connexion between the general death-rate and the business cycle is contrary to expectation. Deaths, both in the United States and England, show a strong tendency to increase with prosperity and diminish with depression. The many and diverse factors influencing the death-rate may possibly affect the correlation. For England, the death-rate was corrected by subtracting the deaths from the principal epidemic diseases (in which the fluctuations are probably not determined by economic events, and which show wide variations). The death-rate, so corrected, still showed a high positive correlation with the business cycle, the maximum of deaths occurring about a year after the peak of prosperity. The influence of climatic changes could scarcely be eliminated, so, although it is difficult to find a satisfactory explanation of the cause of this

phenomenon, the conclusion must be drawn that, in both England and the United States, a high death-rate is associated with periods of prosperity, a low death-rate with periods of depression.

Infant mortality also shows a tendency to increase in times of prosperity and decrease in times of depression, both for England and Wales, and for the United States, although the correlation is weaker, in both instances, than for the general death-rate. In England and Wales the lag of infant mortality, in responding to the business cycle, seems to be something over a year, and slightly less than a year for the United States. The correlation in the United States is somewhat higher than in England and Wales. The direct correspondence of infant mortality and the business cycle is surprising because of the recognized connexion between infant mortality and poverty. Possible factors involved are the greater employment of women in times of prosperity, the greater substitution of artificial for breast feeding at such times, and the tendency for certain infant deaths to occur because of the drunkenness of the parents.

Deaths from tuberculosis, in both countries, show a slight, though variable, tendency to increase with prosperity and diminish with depression. The connexion is not very strong, however, and may not carry any implication of causality.

Suicides in both countries show a strong tendency

to increase during a business depression and decrease during prosperity. The higher correlation for the United States is probably due to the fact that the figures represent suicide-rates in cities only, whereas for England and Wales the figures represent the average rates for the whole country. This high inverse correlation of suicides and business cycles probably results directly from the hardships imposed during a depression. unemployment, pauperism, bankruptcy, restriction of marriages, etc.

Pauperism in England and Wales varies inversely with the business cycle. The most satisfactory series from a statistical point of view, that of indoor pauperism, shows a strong connexion with a lag of about two years, and a somewhat higher connexion in the later years of the period under consideration. Outdoor pauperism shows also a strong correlation, but is somewhat invalidated by changes in administrative policy, etc. In general, however, outdoor pauperism also increases in depression and decreases in prosperity, with a lag of about two years. Even casual pauperism shows a fairly close connexion with the business cycle, and reflects the same tendencies found in the other series. The variations of pauperism probably result largely from the effects of the increased unemployment during a business depression.

The various phenomena of alcoholism in England and Wales are closely correlated with the business

cycle. Per capita consumption of beer and of spirits increase greatly in prosperity and diminish in depression, with a lag of about a year—probably a direct result of the increase in wages, full employment, and general optimism prevalent in prosperity, with other possible determinants, such as the desire to relieve the strain of overtime, to escape uncongenial surroundings, etc., etc. Prosecutions for drunkenness, as might be supposed, also vary closely in connexion with the business cycle and show a lag of a year or more. Finally, and somewhat surprisingly, deaths from alcoholism vary closely with the business cycle, with a lag of slightly more than a year.

Crime, as shown by various series of Judicial Statistics, for England and Wales, gives little evidence of the alleged strong correlation with the business cycle. Crime generally, and larcenies, show a slight tendency to increase in times of depression, and decrease in prosperity. Burglary, housebreaking, and other violent crimes against property, show a much stronger tendency in the same direction. Crimes against the person and against morals show slight tendencies to increase in prosperity, suggesting the possible influence of alcoholism upon such crimes. Changes in law, etc., have made these series somewhat unreliable for long time comparisons. The series used in the study for the United States, convictions for crime in New York

State, showed a fairly strong negative correlation, but it is not possible to generalize from this data about the relative response of crime to economic conditions in the two countries.

In the case of emigration, the decisive factor seems to be the degree of prosperity in the country to which the emigrants are going, rather than that of the country they are leaving. Business prosperity abroad seems to be a cause of emigration, but business depression at home rarely seems to drive people to emigrate. The correlation of emigrants leaving the United Kingdom for the United States with the business cycle of the United States is very high. The correlation of emigration from the United Kingdom and British business cycles tends to be fairly strong and positive, probably due in part to the international aspects of the business cycle, and in part to the need for the emigrants to have a surplus of savings before emigrating.

These various correlations are theoretically significant, for, although causality cannot be claimed merely on the basis of the coefficients of correlation, the large number of cases in which the fluctuations in social phenomena correspond somewhat to the fluctuations in economic phenomena, points to a close relationship. The business cycle is undoubtedly the fundamental factor in determining the fluctuations in many of the social phenomena through its concomitants in times of prosperity, of full employ-

ment, high wages, and increased effective consumers' demand, and, in times of depression, of widespread unemployment, lower wages, and lessened effective consumers' demand.

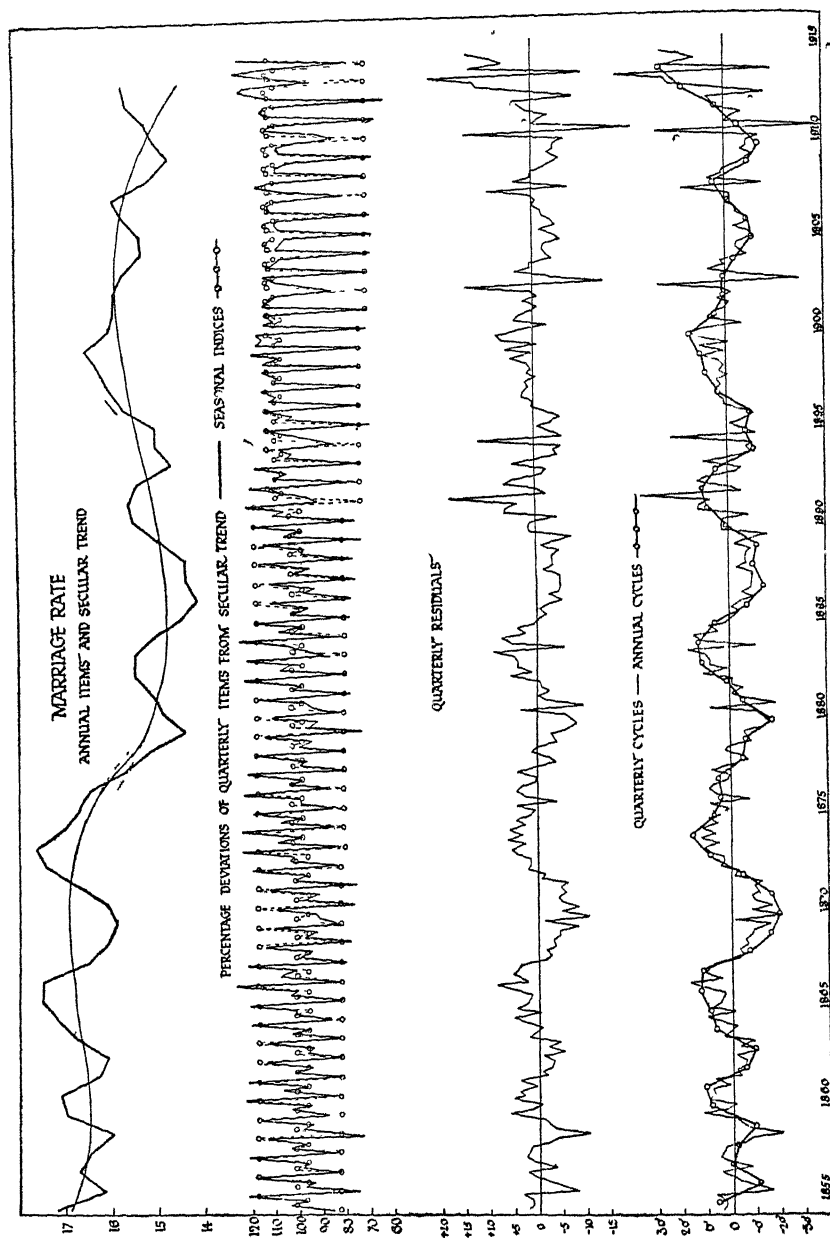
The recurring phases of the business cycle affect directly some of the phenomena studied, for instance, the marriage - rate, pauperism, alcoholism, and emigration. They probably affect the birth-rate directly to some degree, but the differential marriage-rate is undoubtedly another factor of importance in causing fluctuations in the birth-rate—and the same is probably true in regard to the illegitimate birth-rate. Fluctuations in infant mortality may be partly due to the direct influence of the business cycle, partly to the differential birth - rate, and partly to the differential consumption of alcohol. The general death-rate is a function of many variables; it may reflect the business cycle directly and its fluctuations may be due in part to fluctuations in emigration, and perhaps also in part to fluctuations in alcoholism.

Thus, it is evident that the business cycle by influencing, directly, a few social phenomena, may cause "repercussions" in various other spheres of social activity. It is probable that these spheres are much more extensive than this study indicates, but the chief factors involved, which are capable of fairly precise measurement, have been presented here.

The interrelation of these social phenomena and

their response to economic forces raises the question for social theorists as to the part played by group influences upon individual actions. It takes away the emphasis from the individual in many cases, and shifts it towards the group. It brings to light tendencies of importance for the social reformer. It emphasizes the need of bringing about greater economic stability. But, above all, it points strongly to the need of further research into the causes and further scientific analysis of the phases of the business cycle.

METHODS



METHOD CHART.

APPENDIX A

METHODS

IN reducing the data to a form where the cyclical fluctuations in social data can be compared with the cyclical fluctuations in business data—as stated in Chapter I—it is necessary, first, to measure and then to eliminate the long-time movement, or secular trend.

Several methods have been devised for measuring the secular trend :

(1) The method of “ moving averages ” was first developed by Poynting in a paper before the Royal Statistical Society in 1884, in which he compared the relative movements of wheat prices in England, France, and the Bengal. “ In order to determine the fluctuations we need to know the relation of the price to the average of the ten years of which that year is the fifth. Short irregularities are eliminated by taking instead of the price for each year, the average price of the four years of which the given year is the second. The curve is finally drawn showing the four years’ averages as percentages of the corresponding standard.”¹ Here the problem of eliminating trend was merely that of rendering series graphically comparable. Hooker developed the

¹ J. H. Poynting, “ A Comparison of the Fluctuations in the Price of Wheat, etc.,” *J R S S*, vol. XLVII, 1884, pp. 34–64

method further in applying it to time correlation.¹ He emphasized the necessity of eliminating secular trend in order to measure the correspondence of the oscillations. He claimed that the trend was best eliminated by reckoning the deviations of annual items from the "instantaneous averages", i.e. the average of the nine years of which the given year is the centre.

An alternative method of removing secular trend is to fit a straight line or parabola to the data by the method of least squares. The assumption is that, if the observations be dependent on both short-time causes and long-time causes, the part dependent on long-time causes is a function of time and may be written $f(t) = a + bt^2 + ct^3 + \dots + \dots + \dots$. The constants are found by the method of least squares. This method can be successful only when the series is rapidly convergent and the first few terms of the equation used a good approximation, since the labour involved in fitting a more complicated function than a third or fourth degree parabola is prohibitive.

Since the trend may be determined by several methods, and since it may take any one of many different forms, it is obvious that we cannot find the absolute trend of the data² and must regard any

¹ Loc cit

² Discussing this point in relation to a paper read by Yule at the Royal Statistical Society in July, 1921, Greenwood said "The representation of secular trend by a parabola of any order is only a matter of inter-

trend as being empirical. The problem is to select by observation the type of curve which seems best to represent the trend of the data. The trend thus obtained must be conceived as being applicable only to the data to which it is fitted, and not a method of projecting the possible future trend of the data.

On the whole, it was thought that the method of curve fitting gave a better approximation to the trend than the method of moving averages. For it is especially important that all the available data be used in the correlations, and moving averages do not permit the use of the first and last three or four items. A more serious difficulty of the moving average is that, if the true trend is a convex curve, the moving average would be above this curve, and would cause an error in the residuals, the degree of the error depending on the amount of convexity in the curve.¹ Furthermore, the moving average is open to a difficulty in choosing the period of the average. If the data are definitely periodic the moving average should be taken for a period corresponding

polatory convenience. To suppose that a fitted curve by least squares is the secular trend in a wider sense is an illusion, as proved by extrapolation." Tractenberg said: "In referring to secular trend, one means only such a cumulative process as continues throughout the series one is examining, without regard to the effect of extrapolation." Yule replied: "The sole problem of determining the trend is one of interpolation. The trend is simply the line given when the particular oscillations with which it is desired to deal are removed from the data."

¹ It is possible to devise methods for eliminating this error of the moving average due to the convexity or concavity of the data, but the result is more cumbersome and less straightforward than curve fitting.

to the average length of the oscillations in the data, but if the oscillations are irregular (as in all the series in this study) a moving average with a fixed period will tend to give an error.

Fitting the data with straight lines and parabolæ is also open to objections. The data are rarely sufficiently convergent to prevent the parabolic trend from accentuating too greatly the extreme items. Furthermore, the selection of the most satisfactory curve to represent the trend depends more on judgment and experience than upon any objective standards. It seems, however, to be the most satisfactory method of representing the trends of the data in this study. A determining factor in the selection of this method was the unmistakable concavity or convexity observed in the trend of almost all the social series, and many of the business series. It was thought desirable to avoid cumbersome corrections and use a trend which expressed directly the convexity or concavity. Furthermore, data extending over such a long period frequently showed a change in the direction and the rate of increase or decrease of the secular trend. To fit such data with moving averages would require further corrections. The most convenient solution seemed to be to fit two parabolæ or straight lines to the data, representing the two trends. These curves were usually computed for overlapping periods and the juncture smoothed graphically (as illustrated in

Method Chart). Another reason for choosing this method of fitting the trend is that, from a fairly wide experience in fitting trends to economic and social data, I have found that the series most often conform to the shape taken by third degree parabolæ. There is nothing in the nature of a law in this assumption, but it has been found to give the most satisfactory trend in a large number of cases.

The elimination of the secular trend, then, is accomplished by fitting the annual data with a curve representing the long-time movement of that data. The annual variations from this curve represent the cyclical element, plus a random contribution which it is impossible to measure and eliminate. The percentage deviations of the data from the trend are, therefore, taken to represent the cyclical fluctuations of the series. For purposes of comparison, these residuals are divided by their standard deviation¹ to render them strictly comparable with other series. This renders graphical comparison possible, because the standard deviation of any series is an index of the absolute variation of that series. Dividing by the standard deviation does not affect the relative variability from one year to the next within the series, but makes the degree of variations

¹ The "standard deviation" represents an average of the deviations of the items in a series from the average of the series. The formula is $\sqrt{\frac{ex^2}{n}}$, where ex^2 is the sum of the squares of the deviations from the average and n the number of cases.

from one year to the next, in several series, measurable in the same units.

Where quarterly data are used, it is also necessary to eliminate the element of seasonal variation, if this variation tends to be periodic. The use of quarterly data for most of the comparisons in this study was found to be inadvisable because of the difficulty of obtaining accurate data by quarters extending back over a long enough period, and because of the disproportionate amount of labour such an investigation would involve. In Chart I,¹ will be seen the quarterly indices of business cycles.

The method by which the seasonal element was removed, will be described briefly, and no attempt made to justify it theoretically. It follows the "Harvard method" developed by Professor Persons and his associates. A full discussion of this method is found in the *Harvard Review of Economic Statistics*, Preliminary vol., number 1, January 1919, pp. 18-31.

The evidence of seasonal variation is revealed by regularly recurring shifts in the relation of the four quarters. The emphasis in this method is, therefore, laid on measuring the seasonal variation by percentages in which the preceding quarter is the base. These percentages are termed "link relatives". These relatives tend (if a frequency table is formed) to be clustered together at some point—therefore

¹ The quarterly data on which Chart I is based are all readily available, but are not included in the tables appended to this study.

their average is an index of the seasonal relative. The median of each frequency group is taken as the best index of the seasonal relative. This results in four medians of link relatives for each series. These medians are multiplied serially in order to get "chain relatives" with the first quarter as base. If there is a marked secular trend, these chain relatives, if continued, show a discrepancy which is distributed, according to the compound interest law, among the four chain relatives. These corrected chain relatives are then expressed in terms of a fixed base, their arithmetic average, giving finally the seasonal indices. These seasonal indices are then subtracted from the "percentage deviations of original items from secular trend", and then, as above, the residuals are divided by their standard deviations.

After the secular trend (and, for the quarterly data, the seasonal element) is eliminated from the several series, it is possible to compare the cyclical movements or oscillations. The simplest method of comparison is to chart the series, expressed in terms of comparable units, one above the other. Then it is possible to trace out the correspondence of the cycles and get a rough estimate of the degree of relationship between the series. This is, however, not merely a rough method but, scientifically speaking, a dangerous one. If there is a very high correspondence between two curves, with the maxima of the

two almost invariably synchronizing, it is justifiable from observation of the graphs of the two series to claim a high correlation between them. Thus, it is obvious from the curves of the business cycle and the marriage-rate that, when business indices are at their highest point, marriages are most numerous, and when business is depressed the fewest number of marriages occur (see Chart II). It is quite obvious from observation of Chart II that there is a high correlation between the business cycle and the marriage-rate, and refined statistical calculations tell very little more than observation. Where the correspondence is not invariable, however, as in some of the crime series (see Chart VII)—where, in some cases, crimes against property increase with business depression, but, in other cases do not, it is impossible to get a satisfactory estimate of the degree of correspondence between the two curves by the method of graphical comparison. Indeed, it is probable that the correspondence between any two series which move in cycles is greatly exaggerated by graphical comparison, for the longer one looks at such curves, the greater the optical illusion of correspondence becomes. This method is particularly dangerous if one starts an investigation with a bias—and who can claim to approach the subject of the economic influences in social life without some sort of bias? It is even possible for two persons with opposed biases to take the same series and each claim

loudly that correspondence or non-correspondence is absolutely apparent. Unless the correspondence is practically invariable the method of graphical comparison must be supplemented by a method which will give an objective standard, free from the bias of the investigator. And, since most social phenomena may be supposed to respond to a large number of influences, only one (though perhaps the predominant) being economic in origin, the correspondence between the business cycle and any social phenomenon will probably *not* be invariable. It is important, therefore, to supplement graphical comparison by some other method which will give a comparable coefficient of the degree of correspondence between two series and which will tend to weight the correspondence of each pair of items in the two series. The "correlation coefficient", originally devised to express the degree of relationship between normally distributed biological characteristics, has since been extended as a measure in comparing time series, and has come into common use in modern studies of the relationship of economic time series. Its great advantage is that it is a sensitive index of the degree of relationship between two series, since it represents the result of pairing all of the items of the two series to be correlated. The correlation coefficient between two series is high if large items of one series are associated with large items of the other series, and small items of the

one series associated with small items of the other series. Correlation is positive if positive items of the one series synchronize with positive items of the other, and is negative if positive items of one series synchronize with negative items of the other series, and vice versa. There is no correlation if small and large, negative and positive items of the two series are indiscriminately associated. The measure of correlation used here is the one in common use, the so-called "Pearsonian coefficient", i.e., X and Y being the two variables, and r

the relationship between them, $r = \frac{\frac{\sum XY}{n} - (\bar{X} \bar{Y})}{\sigma_x \sigma_y}$.

σ = standard deviation.

n = number of cases.

For perfect positive correlation, $r = +1$, for perfect negative correlation, $r = -1$.¹ Therefore, in any two series with which this study deals, the coefficient of correlation between them will be something between ± 1 . The actual interpretation of intermediate coefficients is rather difficult, for, although ± 1 has a definite and absolute meaning of perfect correlation, intermediate values of the coefficient cannot have any such absolute interpretation. Any particular coefficient gains meaning chiefly in comparison with other coefficients. Thus, if one series "lags" behind the other, the measurement of the lag is made possible by comparing ~~coefficients~~

¹ A. L. Bowley, *Elements of Statistics*, London (see p. 354 for proof that $-1 \leq r \leq +1$).

obtained with different pairings of the items.¹ The value of the coefficient has a certain significance in a study of this sort in showing how closely several different series of social phenomena respond to the business cycle, and in measuring the differential response. Thus, it is evident that the marriage-rate has responded very quickly and sensitively to changes from prosperity to depression. The coefficient expressing that relationship, therefore, may be considered "high", and used as a standard in interpreting coefficients of correlation between the business cycle and similar social series, which will be considered "high", "moderate", or "low" in comparison with this standard.

The *exact* interpretation² of these coefficients is, however, not possible. For instance, if the correlation coefficient between series *a* and series *b* is $+ \cdot 50$, and between series *a* and series *c* is $+ \cdot 25$, it is not possible to claim that "the correspondence between *a* and *b* is twice as close as the correspondence between *a* and *c*". Nor can it be said that a

¹ "A coefficient of correlation computed from economic data is not significant merely because of its absolute size. It is significant because of its size as compared with the size of other coefficients computed for the same two series but for other pairings of the items" W M Persons, *Review of Economic Statistics* (Harvard), prel. vol no 2, April, 1919, p 133.

² Bowley shows that the true correlation coefficients is known only if there is an infinite number of observations. The *r* obtained from a sample "may differ from its true value by an amount whose standard deviation

measured on the normal scale of error is $\frac{1-r^2}{\sqrt{n}}$ If we do not know the

coefficients a priori we must read with our calculated value $\pm \frac{1-r^2}{\sqrt{n}}$.

Op. cit., p 380.

coefficient of, say $+ \cdot 75$ means that in three fourths of all possible cases the relationship will hold invariably, and that there will be no relationship at all in the remaining fourth of the cases.

The measurement usually taken for the significance of the coefficient of correlation is $\frac{1-r^2}{\sqrt{n}}$ where r is the coefficient of correlation and n the number of double items included. This is, in fact, an approximation to a more elaborate formula and is reached only if the items are normally distributed, on which question there is little evidence in the cases under discussion. If, however, we take as a test of significance that r should be as much as three times the value of this expression, we are on fairly safe ground (unless n is very small)¹ and are following the usual custom. Although the meaning is not clear-cut and absolute, the value of such a test of significance lies in the fact that it is a function both of the size of the coefficient and of the number of items used in its computation. It is a useful device, because it acts as a check upon the acceptance of low coefficients² as being of too great value when based on a very small number of items. The standard

¹ The standard deviation can, of course, be computed for coefficients of correlation without any assumption as to its distribution. The formula, which can be found in Bowley's *Elements*, p. 122, however, contains so many terms that its compilation is entirely impractical for a study of this sort.

² In an experiment carried out on the distribution of r for a small sample ($n=2$ to $n=25$) by Soper, Young, Cave, Lee, and Pearson, it was found that "long after we have reached the limit of what are usually treated as small samples, the skewness of the distribution of r is very considerable . . . the 'probable error' of the correlation coefficient has very little worth." *Biometrika*, vol. xi, pt. iv, p. 351.

deviation would be much larger for a coefficient of $\pm .25$ based on only ten items than for the same coefficient based on one hundred items. The significance of a coefficient of correlation varies inversely with the size of its standard deviation. It may safely be said that a coefficient of correlation which is not greater than its standard deviation is meaningless and there is little doubt of its significance if it is many times greater than its standard deviation¹ The coefficient of correlation, then, does *not* give an absolute standard of judgment of the relationship between two phenomena. For the purpose of this study, however, it is sensitive enough to measure the relative degree of correspondence of the several social series with the ebb and flow of the business cycle. A coefficient of correlation for a small sample ($n = 18$ to 21) is held to be significant if it attains a value of $\pm .30$ For a larger sample ($n = 55$ to 60) $\pm .20$ is held to have some significance²

¹ Frequently the "probable error" is used as a test of significance instead of the standard deviation. The probable error is 6745 of the standard deviation, and represents "that divergence, on the average, on either side of the coefficient, within which exactly half the values of a large number of coefficients would lie if computed from pairs of items chosen at random from a universe having in general the given degree of correlation." *Rev of Econ Stats*, prel vol no 2, April, 1919, p 126

The probable error is *not* used in this study because it has even less meaning than the standard deviation in testing the significance of coefficients relating to economic and social time series, with unknown forms of distribution

² Hooker accepted $\pm .50$ as showing a real connexion between two series, with a ~~small~~ sample of 21 . He considered coefficients of $\pm .30$ to $\pm .50$ as being suggestive of dependence. Yule said that it was "largely a point of personal taste what limit one would take in any case." R. H. Hooker "On the Correlation of the Weather and the Crops", *J R.S.S.*, 1907.

To summarize the methods used in this study :

(1) The material consists of homogeneous series of annual or quarterly statistics of economic and social phenomena.

(2) The period extends, wherever possible, from 1854-1913. 1854 is taken as the earliest possible year, partly because it is the first year in which statistics of exports comparable with later years are available, and partly because few reliable social statistics extend back any further. 1913 is obviously the last year in which the business cycle could make its influence felt uncomplicated by other more disturbing factors. The post-war period is too short to give satisfactory results.

(3) Each series is reduced to a form comparable with other series by the following methods :

(a) The secular trend is found by fitting a suitable curve or curves to the annual data by the method of least squares.

(b) The secular trend is eliminated by computing for each year the percentage deviations of the original items to the line of secular trend

(c) If quarterly data are used, the indices of seasonal variation are computed by finding the medians of the "link relatives" (each quarter divided by the previous quarter), ~~expressing the~~ medians on the first quarter base, distributing the discrepancy due to secular trend progressively, and

reducing the indices thus corrected to the base of their arithmetic average.

(d) The quarterly indices are subtracted from the percentage-deviations-of-original-items-from-secular-trend.

(e) The "residuals" are expressed in terms of their standard deviation. This process renders the fluctuations of any series strictly comparable with the fluctuations of any other series similarly expressed. The residuals in terms of standard deviation represent the cyclical fluctuation of the original items, and are designated "cycles".

(4) The cycles of the several series of business statistics are averaged, giving a single series representing "British Business Cycles".

(5) The cycles of each series of social statistics are correlated with British Business Cycles by the

usual formula, $r = \frac{\frac{\sum XY}{n} - (\bar{X} \bar{Y})}{\sigma_x \sigma_y}$.

(6) The correlation coefficients are expressed with their standard deviations.

APPENDIX B

TABLES

THE following tables include all of the raw material from which the correlation coefficients given in Chapters III to IX were computed. They are arranged in three groups for each chapter. Table A represents the original items of the series dealt with in that chapter. Table B gives the formulæ for the lines of secular trend, computed from the original items as described in Appendix A. Table C gives the original items, corrected for secular trend, and expressed in terms of standard deviations. Thus, the items in Table C for any series are strictly comparable with the items in Table C for any other series. The charts given in each chapter represent these corrected series shown in Table C.

CHAPTER I

TABLE A

ORIGINAL ITEMS OF SERIES OF BRITISH BUSINESS STATISTICS

- A Value of Total Exports of British Produce.
 B Sauerbeck Index Numbers of All Materials.
 C Percentage Unemployed—"All Trades"
 D Production of Pig Iron, U.K. (British and foreign ores)
 E Production of Coal, U.K.
 F Railway Freight Traffic Receipts
 G. Provincial Bank Clearings (Manchester and Birmingham)

| | A | B | C | D | E | F | G |
|------|-----------|-----|------|--------------|--------------|-----------|-----------|
| | Mill £ | % | % | Mill Tons | Mill Tons | Mill £ | Mill £ |
| 1854 | 8.1 | 104 | | | | | |
| 1855 | 8 0 | 101 | | | | | |
| 1856 | 9.7 | 102 | | | | | |
| 1857 | 10 2 | 107 | | | | | |
| 1858 | 9 7 | 94 | | | | | |
| 1859 | 10 9 | 98 | | | | | |
| 1860 | 11 3 | 100 | 1 9 | | | | |
| 1861 | 10 4 | 99 | 3 7 | | | | |
| 1862 | 10 3 | 107 | 6 0 | | | | |
| 1863 | 12 2 | 115 | 4 7 | | | | |
| 1864 | 13.4 | 119 | 2.0 | | | | |
| 1865 | 13 8 | 108 | 1 8 | 4 82 | 98 | | |
| 1866 | 15.7 | 107 | 2 7 | 4 52 | 102 | | |
| 1867 | 15 1 | 100 | 6 3 | 4 76 | 105 | | |
| 1868 | 15 0 | 99 | 6 8 | 4 97 | 103 | | |
| 1869 | 15 8 | 100 | 6 0 | 5.45 | 107 | | |
| 1870 | 16.6 | 99 | 3 8 | 5 96 | 110 | | |
| 1871 | 18 6 | 101 | 1 6 | 6 63 | 117 | | |
| 1872 | 21.4 | 115 | 9 | 6 74 | 124 | | |
| 1873 | 21 3 | 114 | 1 2 | 6.57 | 127 | | |
| 1874 | 20 0 | 100 | 1 7 | 5 99 | 125 | | |
| 1875 | 18 6 | 93 | 2 4 | 6 37 | 132 | | |
| 1876 | 16 7 | 91 | 3 7 | 6 56 | 133 | | |
| 1877 | 16.6 | 89 | 4 7 | 6 61 | 134 | | |
| 1878 | 16 1 | 81 | 6 8 | 6.38 | 133 | | |
| 1879 | 16 0 | 78 | 11 4 | 6 00 | 134 | | |
| 1880 | 18 6 | 94 | 5 5 | 7 75 | 147 | | |
| 1881 | 19.5 | 80 | 3 5 | 8 14 | 154 | 2 77 | |
| 1882 | 20 1 | 80 | 2 3 | 8.59 | 157 | 2 85 | |
| 1883 | 20 0 | 77 | 2 6 | 8 53 | 164 | 2 93 | |
| 1884 | 19 4 | 73 | 8 1 | 7 81 | 161 | 2 85 | |

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TABLE A (*continued*)

| | A | B. | C | D. | E | F | G. |
|------|-----------|----|------|--------------|--------------|-----------|-----------|
| | Mill £ | % | % | Mill Tons | Mill Tons | Mill £ | Mill £ |
| 1885 | 17 8 | 70 | 9 3 | 7 42 | 159 | 2.79 | |
| 1886 | 17 7 | 67 | 10.2 | 7 01 | 158 | 2 74 | |
| 1887 | 18.5 | 67 | 7 6 | 7 56 | 162 | 2 85 | 11.9 |
| 1888 | 19 5 | 69 | 4.9 | 8 00 | 170 | 2.91 | 12.7 |
| 1889 | 20 8 | 70 | 2.1 | 8 32 | 177 | 3 08 | 14.0 |
| 1890 | 22 0 | 71 | 2.1 | 7 90 | 182 | 3 19 | 15.8 |
| 1891 | 20.6 | 68 | 3 5 | 7 41 | 186 | 3 25 | 15.9 |
| 1892 | 18 9 | 65 | 6 3 | 6 71 | 182 | 3.28 | 15 5 |
| 1893 | 18 2 | 65 | 7 5 | 6 98 | 164 | 3 05 | 15.1 |
| 1894 | 18.0 | 60 | 6 9 | 7 43 | 188 | 3.26 | 15.7 |
| 1895 | 18 8 | 60 | 5.8 | 7 70 | 190 | 3.28 | 16 2 |
| 1896 | 20 0 | 60 | 3 3 | 8 66 | 195 | 3 45 | 18 8 |
| 1897 | 19 5 | 59 | 3 3 | 8 80 | 202 | 3 55 | 19.1 |
| 1898 | 19 4 | 61 | 2 8 | 8 61 | 202 | 3 70 | 19.9 |
| 1899 | 22 0 | 70 | 2 0 | 9.42 | 220 | 3.88 | 21 3 |
| 1900 | 24 3 | 80 | 2 5 | 8 96 | 225 | 3 99 | 23.2 |
| 1901 | 23 3 | 72 | 3 3 | 7.93 | 219 | 3 91 | 22.1 |
| 1902 | 23 6 | 71 | 4.0 | 8 68 | 227 | 4 10 | 22.4 |
| 1903 | 24.2 | 72 | 4 7 | 8 94 | 230 | 4.11 | 22.3 |
| 1904 | 25 1 | 72 | 6.0 | 8 69 | 232 | 4.14 | 23.2 |
| 1905 | 27.5 | 75 | 5 0 | 9 61 | 236 | 4.21 | 24.7 |
| 1906 | 31 3 | 83 | 3 6 | 10.18 | 251 | 4 37 | 27.1 |
| 1907 | 35 5 | 86 | 3 7 | 10 11 | 268 | 4.59 | 29.4 |
| 1908 | 31.4 | 74 | 7 8 | 9 06 | 262 | 4 40 | 26.5 |
| 1909 | 31 5 | 75 | 7 7 | 9.53 | 264 | 4.45 | 26.3 |
| 1910 | 35 9 | 81 | 4.7 | 10 12 | 264 | 4 62 | 28.4 |
| 1911 | 37 8 | 83 | 3 0 | 9 53 | 272 | 4.76 | 30.9 |
| 1912 | 40 6 | 88 | 2 2 | 8 75 | 260 | 4 80 | 31.9 |
| 1913 | 43 8 | 91 | 2 1 | 10 26 | 287 | 4.93 | 34.3 |

Sources of data in Table A —

- A Monthly Trade Returns
- B *The Statist*
- C Abstract of Labour Statistics.
- D Statistical Abstract, U.K.
- E Statistical Abstract, U.K.
- F *The Statist*
- G *The Banker's Magazine*

CHAPTER I

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF BRITISH BUSINESS STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|--|
| A | 1854-1884 | 1869 | $y = 16.22 + .473x - .01358x^2 - .0004881x^3$ |
| | 1885-1913 | 1899 | $y = 21.73 + .638x + .04799x^2 + .001225x^3$ |
| B | 1846-1884 | 1865 | $y = 106.13 + .194x - .0962x^2 - .001051x^3$ |
| | 1885-1913 | 1899 | $y = 67.45 + .978x + .0636x^2 - .00196x^3$ |
| C | 1860-1912 | 1886 | $y = 4.489 - .017x$ |
| D | 1865-1913 | 1889 | $y = 7.787 + .0956x - .0008418x^2$ |
| E | 1865-1913 | 1889 | $y = 173.488 + 3.733x + .03062x^2$ |
| F | 1881-1913 | 1897 | $y = 3.572 + .085x + .001046x^2 - .0000845x^3$ |
| G | 1887-1913 | 1900 | $y = 21.1 + .701x + .00915x^2 + .0006207x^3$ |
| D' | 1897-1913 | 1905 | $y = 317.41 - 5.09x + 2105x^2 + .02394x^3$ |
| E' | 1855-1893 | 1874 | $y = 8.3282 - .05808x$ |

- A Exports of British Produce
 B Sauerbeck Index Number All Materials
 C Percentage Unemployed. "All Trades."
 D Production of Pig Iron, U K
 E. Production of Coal, U K
 F Railway Freight Traffic Receipts
 G Provincial Bank Clearings
 D' Blast Furnaces in Blast
 E' Percentage Unemployed Ironfounders

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CHAPTER I

* TABLE C

BRITISH BUSINESS CYCLES

Percentage deviations of annual items from secular trend for each series of British business statistics, expressed in terms of standard deviation.

- A Exports of British Produce
 B Sauerbeck Index Number All Materials
 C Percentage Unemployed "All Trades"
 D Production of Pig Iron, U K
 E Production of Coal, U K
 F Railway Freight Traffic Receipts
 G Provincial Bank Clearings

| Standard dev | A 8 08% | B 7 40% | C 54 6% | D 8 77% | E 3 59% | F 2 69% | G 5 25% | Average |
|--------------|------------|------------|------------|------------|------------|------------|------------|---------|
| 1854 | + 62 | +1 49 | | | | | | +1 06 |
| 1855 | - 45 | + 76 | | | | | | + 16 |
| 1856 | +1 27 | + 66 | | | | | | + 97 |
| 1857 | +1 06 | +1 10 | | | | | | +1 08 |
| 1858 | - 37 | - 88 | | | | | | - 63 |
| 1859 | + 37 | - 47 | | | | | | - 05 |
| 1860 | + 11 | - 35 | +1 15 | | | | | + 30 |
| 1861 | -1 47 | - 61 | + 45 | | | | | - 54 |
| 1862 | -2 11 | + 28 | - 41 | | | | | - 75 |
| 1863 | - 79 | +1 25 | + 71 | | | | | + 39 |
| 1864 | - 19 | +1 73 | +1 08 | | | | | + 87 |
| 1865 | - 26 | + 23 | +1 15 | - 43 | - 89 | | | - 04 |
| 1866 | + 84 | + 95 | + 81 | -1 37 | - 56 | | | + 13 |
| 1867 | - 07 | - 81 | - 57 | -1 13 | - 48 | | | - 61 |
| 1868 | - 56 | - 86 | - 77 | -1 03 | -1 40 | | | - 92 |
| 1869 | - 30 | - 70 | - 47 | - 18 | - 95 | | | - 52 |
| 1870 | - 06 | - 73 | + 37 | + 59 | - 73 | | | - 11 |
| 1871 | +1 09 | - 35 | +1 22 | +1 66 | + 28 | | | + 78 |
| 1872 | +2 75 | +1 66 | +1 49 | +1 56 | +1 11 | | | +1 71 |
| 1873 | +2 36 | +1 74 | +1 37 | +1 02 | +1 25 | | | +1 55 |
| 1874 | +1 23 | + 11 | +1 17 | - 33 | + 20 | | | + 48 |
| 1875 | + 06 | - 59 | + 89 | + 16 | + 98 | | | + 29 |
| 1876 | -1 33 | - 59 | + 38 | + 28 | + 73 | | | - 11 |
| 1877 | -1 53 | - 55 | - 02 | + 17 | + 22 | | | - 34 |
| 1878 | -1 90 | -1 37 | - 86 | - 44 | - 78 | | | -1 07 |
| 1879 | -2 02 | -1 42 | -2 69 | -1 26 | -1 17 | | | -1 71 |
| 1880 | - 35 | + 05 | - 37 | +1 48 | + 87 | | | + 34 |
| 1881 | + 25 | - 22 | + 43 | +1 94 | +1 69 | - 78 | | + 55 |
| 1882 | - 73 | + 65 | + 91 | +2 41 | +1 46 | + 41 | | + 85 |
| 1883 | + 77 | +2 25 | + 78 | +2 25 | +2 06 | +1 49 | | +1 60 |
| 1884 | + 52 | +1 04 | -1 45 | + 82 | + 92 | + 30 | | + 36 |
| 1885 | - 73 | - 32 | -1 95 | + 07 | + 06 | - 78 | | - 61 |
| 1886 | - 80 | - 54 | -2 34 | - 73 | - 85 | -1 86 | | -1 19 |
| 1887 | - 29 | - 26 | -1 28 | - 05 | - 70 | - 74 | - 50 | - 55 |
| 1888 | + 37 | + 42 | - 18 | + 47 | + 28 | - 52 | - 31 | + 08 |

CHAPTER III

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|--|
| A | 1854-1878 | 1866 | $y = 16.832 + .0528x - .00409x^2 - .000726x^3$ |
| | 1876-1912 | 1894 | $y = 15.332 + .0854x + .0000013x^2 - .000361x^3$ |
| B | 1858-1880 | 1869 | $y = .837 + .0479x + .0022x^2 - .000203x^3$ |
| | 1879-1913 | 1896 | $y = 1.512 + .0252x + .000451x^2 + .0000018x^3$ |
| C | 1857-1889 | 1873 | $y = 38.2 + .555x - .0079x^2 - .004282x^3$ |
| | 1889-1913 | 1901 | $y = 29.9 + .822x - .0225x^2 - .005131x^3$ |

- A Marriage-rates, England and Wales.
 B Divorce-rates, England and Wales.
 C Prosecutions for Prostitution (Rates).

CHAPTER III

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics,
expressed in terms of standard deviation

A Marriage-rates, England and Wales

B Divorce-rates, England and Wales

C. Prosecutions for Prostitution, England and Wales

| Standard dev. | A | B | C | Standard dev. | A | B | C |
|---------------|-------|-------|-------|---------------|-------|-------|-------|
| | 3.22% | 9.6% | 11.0% | | 3.22% | 9.6% | 11.0% |
| 1854 | + .65 | | | 1884 | + .56 | — .18 | +1.52 |
| 1855 | —1.03 | | | 1885 | — .68 | —1.04 | + .45 |
| 1856 | + .16 | | | 1886 | —1.37 | + .88 | + .75 |
| 1857 | — .13 | | + .02 | 1887 | — .97 | + .64 | + .98 |
| 1858 | — .99 | + .85 | +1.89 | 1888 | —1.09 | + .40 | —2.14 |
| 1859 | + .87 | — .81 | — .80 | 1889 | + .06 | — .47 | — .59 |
| 1860 | +1.06 | —1.29 | — .35 | 1890 | + .97 | + .09 | + .44 |
| 1861 | — .47 | —1.65 | — .80 | 1891 | +1.09 | —1.64 | + .34 |
| 1862 | — .93 | +1.09 | +1.12 | 1892 | + .53 | —1.62 | — .63 |
| 1863 | + .31 | +1.72 | + .78 | 1893 | —1.12 | —1.60 | — .04 |
| 1864 | + .90 | +1.69 | .00 | 1894 | — .72 | —1.38 | +1.10 |
| 1865 | +1.34 | + .16 | — .54 | 1895 | — .94 | + .56 | — .19 |
| 1866 | +1.22 | .00 | —1.57 | 1896 | + .37 | + .49 | — .60 |
| 1867 | — .69 | — .69 | — .67 | 1897 | + .90 | +2.21 | — .55 |
| 1868 | —1.56 | + .42 | —1.86 | 1898 | +1.09 | —1.21 | — .06 |
| 1869 | —1.93 | .00 | — .13 | 1899 | +1.53 | + .40 | — .59 |
| 1870 | —1.56 | — .35 | — .92 | 1900 | + .47 | — .58 | — .81 |
| 1871 | — .41 | —1.21 | +1.74 | 1901 | + .13 | +1.22 | + .43 |
| 1872 | + .99 | —1.25 | +3.08 | 1902 | + .09 | +1.05 | + .49 |
| 1873 | +1.56 | — .29 | +2.05 | 1903 | — .28 | + .81 | + .92 |
| 1874 | + .69 | + .64 | — .06 | 1904 | —1.09 | + .83 | +1.10 |
| 1875 | + .50 | + .91 | — .33 | 1905 | — .94 | + .29 | + .71 |
| 1876 | + .53 | — .44 | — .51 | 1906 | — .06 | + .44 | — .31 |
| 1877 | — .47 | + .32 | — .45 | 1907 | + .50 | — .73 | —1.54 |
| 1878 | — .59 | +2.06 | —1.26 | 1908 | — .90 | + .22 | — .53 |
| 1879 | —1.74 | — .73 | —1.13 | 1909 | —1.34 | + .05 | + .19 |
| 1880 | — .50 | + .32 | + .09 | 1910 | — .50 | —1.70 | + .08 |
| 1881 | + .46 | — .90 | —1.28 | 1911 | + .37 | — .99 | — .33 |
| 1882 | +1.21 | + .42 | — .19 | 1912 | +1.84 | — .71 | + .09 |
| 1883 | +1.31 | + .83 | +1.46 | 1913 | +2.68 | +1.48 | + .46 |

CHAPTER IV

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS.

- A. Birth-rates per 1,000 population, England and Wales.
 B. Illegitimate Birth-rates per 1,000 births, England and Wales.
 C. Death-rates from Childbirth and Pregnancy (non-septic) per 100,000 population, England and Wales
 D. Death-rates from Premature Birth, per 100,000 population, England and Wales.

| | A | B | C | D. | | A | B | C | D |
|------|------|----|------|------|------|------|----|-----|------|
| 1854 | 34 1 | 64 | 11.0 | 38 8 | 1884 | 33 6 | 47 | 6.5 | 48 4 |
| 1855 | 33 7 | 64 | 10.1 | 37 8 | 1885 | 32.9 | 48 | 7.1 | 47 4 |
| 1856 | 34 4 | 65 | 9 6 | 36 4 | 1886 | 32.8 | 47 | 6 3 | 49.5 |
| 1857 | 34.4 | 65 | 10 1 | 39 4 | 1887 | 31 9 | 48 | 5 9 | 50.6 |
| 1858 | 33 7 | 66 | 10 6 | 37 5 | 1888 | 31 2 | 46 | 6 0 | 49 8 |
| 1859 | 35 0 | 65 | 11 5 | 37 8 | 1889 | 31 1 | 46 | 5 9 | 50.8 |
| 1860 | 34 3 | 64 | 11 0 | 38 4 | 1890 | 30 2 | 44 | 7.7 | 52 9 |
| 1861 | 34.6 | 63 | 10 5 | 37 8 | 1891 | 31 4 | 42 | 9.4 | 56 6 |
| 1862 | 35 0 | 63 | 10 5 | 37 8 | 1892 | 30.4 | 42 | 9 4 | 56 2 |
| 1863 | 35 3 | 65 | 11 8 | 39.2 | 1893 | 30 7 | 42 | 9 6 | 58 0 |
| 1864 | 35.4 | 64 | 12 1 | 39 9 | 1894 | 29 6 | 43 | 8.4 | 52 6 |
| 1865 | 35 4 | 62 | 11 8 | 41 6 | 1895 | 30 3 | 42 | 7 5 | 57.5 |
| 1866 | 35 2 | 60 | 11 6 | 41 8 | 1896 | 29 6 | 42 | 7.9 | 56 3 |
| 1867 | 35 4 | 59 | 10.8 | 41 5 | 1897 | 29 6 | 42 | 7.5 | 57 1 |
| 1868 | 35 8 | 59 | 10.5 | 39 9 | 1898 | 29 3 | 42 | 7 3 | 58 2 |
| 1869 | 34 8 | 58 | 9 5 | 39.0 | 1899 | 29 1 | 40 | 7 4 | 58.2 |
| 1870 | 35 2 | 56 | 10 6 | 40 9 | 1900 | 28 7 | 40 | 7 6 | 57 3 |
| 1871 | 35 0 | 56 | 10 8 | 42 3 | 1901 | 28.5 | 39 | 7 1 | 56.9 |
| 1872 | 35.6 | 54 | 10 4 | 44 7 | 1902 | 28 5 | 39 | 6.5 | 57.4 |
| 1873 | 35.4 | 52 | 10.1 | 43 5 | 1903 | 28 5 | 39 | 6.6 | 57 3 |
| 1874 | 36 0 | 50 | 11 9 | 44.4 | 1904 | 28 0 | 40 | 6 0 | 58.2 |
| 1875 | 35 4 | 48 | 10 6 | 48 6 | 1905 | 27 3 | 40 | 6 4 | 55.5 |
| 1876 | 36 3 | 47 | 9 8 | 47 0 | 1906 | 27 2 | 40 | 6 2 | 55.5 |
| 1877 | 36 0 | 47 | 8 1 | 47 0 | 1907 | 26 5 | 39 | 6 0 | 52.5 |
| 1878 | 35 6 | 47 | 7 4 | 48 0 | 1908 | 26 7 | 40 | 5 6 | 53 1 |
| 1879 | 34 7 | 48 | 7 4 | 47.0 | 1909 | 25 8 | 41 | 5 4 | 51 4 |
| 1880 | 34 2 | 48 | 7 1 | 47.7 | 1910 | 25 1 | 41 | 5 3 | 49 1 |
| 1881 | 33 9 | 49 | 7.4 | 46 2 | 1911 | 24.3 | 43 | 5.2 | 49 0 |
| 1882 | 33 8 | 49 | 7 0 | 47 2 | 1912 | 23.9 | 43 | 5 5 | 46.7 |
| 1883 | 33 5 | 48 | 6 8 | 48 3 | 1913 | 24 1 | 43 | 5 6 | 47.8 |

Source of data in Table A —

Annual Reports of the Registrar-General of England and Wales

CHAPTER IV

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|---|
| A | 1854-1876 | 1865 | $y = 35.12 + .055x - .0024x^2 + .00036x^3$ |
| | 1875-1913 | 1894 | $y = 30.32 - .235x - .00041x^2 - .00028x^3$ |
| B | 1854-1876 | 1865 | $y = 61.89 - .828x - .054x^2 + .00033x^3$ |
| | 1877-1913 | 1895 | $y = 42.11 - .525x + .0114x^2 + .00132x^3$ |
| C | 1854-1890 | 1872 | $y = 10.07 - .259x - .00677x^2 + .00052x^3$ |
| | 1889-1913 | 1901 | $y = 7.11 - .283x - .00363x^2 + .001502x^3$ |
| D | 1854-1882 | 1868 | $y = 41.46 + .608x + .00816x^2 - .00148x^3$ |
| | 1881-1913 | 1897 | $y = 57.12 + .283x - .04532x^2 - .00114x^3$ |

- A Birth-rates per 1,000 population.
 B. Illegitimate Birth-rates per 1,000 births
 C Death-rates from Pregnancy and Childbirth per 100,000 population
 D Death-rates from Premature Birth per 100,000 population.

CHAPTER IV

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics, expressed in terms of standard deviation

A Birth-rates, England and Wales (corrected for periodicity).

B Illegitimate Birth-rates, England and Wales

C Death-rates from Childbearing and Pregnancy, England and Wales

D Death-rates from Premature Birth, England and Wales

| Standard dev | A | B | C | D | Standard dev | A | B | C | D |
|--------------|-------|-------|-------|-------|--------------|-------|-------|-------|-------|
| | 1·20% | 1·65% | 7 79% | 2 79% | | 1 20% | 1·65% | 7 79% | 2 79% |
| 1854 | + .92 | - .79 | +1 98 | + 14 | 1884 | +1 32 | - .85 | - .71 | + .04 |
| 1855 | - .84 | - .97 | + 24 | - .39 | 1885 | +1 12 | +1·15 | + .78 | -1·36 |
| 1856 | + .50 | - .24 | - .93 | -1 40 | 1886 | + .55 | 00 | - .45 | - .36 |
| 1857 | .00 | - .24 | - .69 | +1 62 | 1887 | - .20 | +2 24 | -1 01 | - .18 |
| 1858 | - .80 | + .67 | - .39 | - .22 | 1888 | - .94 | +1 21 | - .59 | -1·29 |
| 1859 | - .28 | -1 21 | + 41 | + 07 | 1889 | -1 77 | + .91 | -1·73 | -1·18 |
| 1860 | -1·01 | - .67 | - .36 | + .47 | 1890 | -1 65 | - .91 | +1·28 | - .29 |
| 1861 | - .50 | -1 21 | -1 02 | + .68 | 1891 | - .48 | -3 15 | +2 12 | +1·80 |
| 1862 | + .25 | - .85 | -1·05 | + .39 | 1892 | - .20 | -2·48 | +1 77 | +1·01 |
| 1863 | + .84 | +1 75 | + .39 | + .36 | 1893 | - .58 | -1·76 | +1·89 | +1·76 |
| 1864 | + .75 | +1 21 | + .76 | + .54 | 1894 | - .70 | + .61 | 00 | -2 12 |
| 1865 | + .75 | + .18 | + .51 | +1 65 | 1895 | - .40 | - .12 | -1 28 | + .75 |
| 1866 | .00 | - .97 | + .40 | +1 44 | 1896 | - .25 | + .55 | - .51 | - .29 |
| 1867 | + .50 | - .97 | - .39 | + .61 | 1897 | - .31 | +1 45 | - .93 | 00 |
| 1868 | +1·17 | + .12 | - .53 | -1·36 | 1898 | - .15 | +2·06 | - .95 | + .61 |
| 1869 | - .45 | + .37 | -1 50 | -2·69 | 1899 | - .15 | - .36 | - .44 | + .43 |
| 1870 | - .82 | + .37 | + .06 | -1 54 | 1900 | - .33 | 00 | + .39 | - .14 |
| 1871 | - .60 | +1 09 | + .58 | - .86 | 1901 | - .33 | - .97 | - .03 | - .39 |
| 1872 | - .32 | + .49 | + .42 | + .72 | 1902 | + .67 | - .79 | - .60 | + .04 |
| 1873 | - .06 | 00 | + .39 | - .83 | 1903 | +1 59 | - .61 | + .13 | + .32 |
| 1874 | 00 | - .24 | +3 20 | - .68 | 1904 | + .92 | +1·09 | - .55 | +1 08 |
| 1875 | - .15 | - .61 | +1 90 | +2 37 | 1905 | + .40 | +1·21 | + .82 | - .22 |
| 1876 | + .42 | + .49 | +1 15 | + .68 | 1906 | + .24 | + .61 | + .91 | + .29 |
| 1877 | + .92 | - .97 | - .84 | + .39 | 1907 | + .35 | - .73 | + .91 | -1·22 |
| 1878 | +1·25 | -1 45 | -1·49 | + .79 | 1908 | + .65 | - .37 | + .30 | - .04 |
| 1879 | + .38 | - .37 | -1 10 | - .14 | 1909 | 00 | + .42 | + .05 | - .47 |
| 1880 | + .19 | - .37 | -1 17 | +1 04 | 1910 | - .67 | - .73 | - .18 | -1·15 |
| 1881 | + .23 | + .91 | - .31 | -1 01 | 1911 | -1·67 | +1·09 | - .53 | - .04 |
| 1882 | + .50 | +1·15 | - .57 | - .18 | 1912 | -1·50 | - .36 | - .14 | - .50 |
| 1883 | +1 01 | + .18 | - .51 | + .36 | 1913 | +1·01 | - .36 | - .40 | -1·69 |

CHAPTER V

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS

- A Death-rates per 1,000 population, England and Wales (less deaths from principal epidemic diseases)
- B Infant Death-rates per 1,000 births, England and Wales (less infant deaths from diarrhoea).
- C Phthisis Death-rates per 100,000 population, England and Wales
- D Suicide-rates per 100,000 population, England and Wales

| | A | B | C | D | | A. | B. | C | D |
|------|------|-----|-----|-----|------|------|-----|-----|------|
| 1854 | 18 1 | | 276 | | 1884 | 16 5 | 127 | 183 | 7.6 |
| 1855 | 19 0 | 143 | 278 | | 1885 | 16 7 | 128 | 177 | 7.4 |
| 1856 | 17 1 | 132 | 257 | | 1886 | 16.8 | 129 | 174 | 8.2 |
| 1857 | 16 8 | 138 | 260 | | 1887 | 16.3 | 127 | 162 | 8.0 |
| 1858 | 18.4 | 147 | 259 | 6 6 | 1888 | 15.9 | 125 | 157 | 8.2 |
| 1859 | 17 9 | 137 | 255 | 6 3 | 1889 | 15 7 | 128 | 157 | 7.6 |
| 1860 | 18 2 | 140 | 256 | 6 9 | 1890 | 17.1 | 135 | 168 | 7.7 |
| 1861 | 18.0 | 138 | 258 | 6 7 | 1891 | 18 0 | 136 | 160 | 8.5 |
| 1862 | 17 8 | 134 | 250 | 6.5 | 1892 | 16.7 | 133 | 147 | 8.8 |
| 1863 | 18.1 | 137 | 248 | 6 4 | 1893 | 16 2 | 131 | 147 | 8.7 |
| 1864 | 19 0 | 139 | 254 | 6 4 | 1894 | 14 4 | 125 | 138 | 9.1 |
| 1865 | 18 8 | 141 | 254 | 6 6 | 1895 | 16 2 | 133 | 140 | 9.2 |
| 1866 | 18 4 | 147 | 260 | 6.2 | 1896 | 14.5 | 127 | 130 | 8.6 |
| 1867 | 18 0 | 136 | 254 | 6.1 | 1897 | 14 9 | 125 | 134 | 9.0 |
| 1868 | 17 0 | 131 | 234 | 6.9 | 1898 | 15.0 | 123 | 131 | 9.1 |
| 1869 | 17 8 | 139 | 235 | 7.1 | 1899 | 15 7 | 123 | 133 | 8.9 |
| 1870 | 18 1 | 139 | 241 | 6 9 | 1900 | 15 8 | 126 | 133 | 9.0 |
| 1871 | 17 7 | 138 | 234 | 6 6 | 1901 | 14 5 | 119 | 126 | 9.6 |
| 1872 | 17.0 | 132 | 228 | 6.6 | 1902 | 14.3 | 118 | 123 | 9.9 |
| 1873 | 17.7 | 132 | 219 | 6 5 | 1903 | 13.7 | 114 | 121 | 10.5 |
| 1874 | 18.1 | 134 | 208 | 6.7 | 1904 | 14.1 | 115 | 124 | 9.9 |
| 1875 | 18 9 | 140 | 220 | 6 7 | 1905 | 13 6 | 107 | 115 | 10.4 |
| 1876 | 17 4 | 129 | 213 | 7 3 | 1906 | 13 5 | 101 | 116 | 10.1 |
| 1877 | 17.3 | 126 | 208 | 6 9 | 1907 | 13.6 | 105 | 115 | 10.2 |
| 1878 | 17 8 | 134 | 211 | 7 0 | 1908 | 13 3 | 100 | 112 | 10.7 |
| 1879 | 18 0 | 128 | 202 | 8 0 | 1909 | 13.3 | 96 | 109 | 10.1 |
| 1880 | 16 9 | 132 | 187 | 7 7 | 1910 | 12 4 | 92 | 102 | 10.0 |
| 1881 | 16 3 | 119 | 183 | 7 5 | 1911 | 12 7 | 94 | 106 | 9.9 |
| 1882 | 16.5 | 129 | 185 | 7 4 | 1912 | 12 2 | 87 | 102 | 9.8 |
| 1883 | 17.0 | 126 | 188 | 7.3 | 1913 | 12.5 | 89 | 98 | 9.5 |

Source of data in Table A —

Annual Reports of the Registrar-General of England and Wales

CHAPTER V

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|--|
| A | 1854-1874 | 1864 | $y = 18.09 - 0.0544x - 0.0376x^2 - 0.00142x^3$ |
| | 1875-1913 | 1894 | $y = 15.70 - 1.257x - 0.02041x^2 - .000839x^3$ |
| B | 1855-1891 | 1873 | $y = 133.27 - .867x + .00494x^2 + .00234x^3$ |
| | 1889-1913 | 1901 | $y = 118.80 - 2.398x - .06804x^2 + .00377x^3$ |
| C | 1854-1912 | 1883 | $y = 184.53 - 3.877x + .004072x^2 + .00129x^3$ |
| D | 1858-1890 | 1874 | $y = 6.91 + .0759x + .001466x^2 - .0001507x^3$ |
| | 1889-1913 | 1901 | $y = 9.73 + 1.325x - .006498x^2 - .0004408x^3$ |

A. Death-rates (less deaths from epidemic diseases)

B. Infant Mortality (less infant deaths from diarrhoea).

C. Phthisis Death-rates

D. Suicide-rates

CHAPTER V

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics expressed in terms of standard deviation.

- A Death-rates (less deaths from epidemic diseases)
 B Infant Mortality (less infant deaths from diarrhoea)
 C Phthisis Death-rates.
 D Suicide-rates.

| Standard dev | A | B | C | D | Standard dev | A | B | C | D |
|-----------------|-------|-------|-------|-------|-----------------|-------|-------|-------|-------|
| | 3 67% | 2 77% | 3 27% | 3 86% | | 3·67% | 2·77% | 3·27% | 3·86% |
| 1854 | + 30 | | + 86 | | 1884 | - 52 | - .18 | + 34 | - 23 |
| 1855 | +1 66 | +1 66 | +1 16 | | 1885 | 00 | + 14 | .00 | -1 09 |
| 1856 | -1 39 | -1 52 | -1 16 | | 1886 | + 30 | + 29 | + .18 | +1·45 |
| 1857 | -1 82 | - 22 | - 61 | | 1887 | - 33 | - 43 | -1·25 | + .57 |
| 1858 | + 57 | +1 88 | - 58 | - 28 | 1888 | - .82 | -1 19 | -1 50 | +1·09 |
| 1859 | - .33 | - 79 | - .86 | -1·24 | 1889 | - 98 | - .61 | - .95 | -1·17 |
| 1860 | + 19 | - .11 | - 46 | +1·40 | 1890 | +1·52 | + 94 | +1·93 | -1·17 |
| 1861 | - .16 | - 62 | 00 | + 80 | 1891 | +3 24 | +1 05 | + 98 | +1·04 |
| 1862 | - 44 | -1 62 | - 73 | + 13 | 1892 | +1 36 | + .18 | - .86 | +1·50 |
| 1863 | .00 | - .79 | - 61 | - 30 | 1893 | + .71 | - 18 | .00 | + .75 |
| 1864 | +1·36 | - .18 | + 34 | - .16 | 1894 | -2 28 | -1 62 | -1 32 | +1·42 |
| 1865 | + .87 | + .40 | + 73 | + 54 | 1895 | +1·01 | + 90 | - 18 | +1·27 |
| 1866 | + 44 | +2 17 | +1·87 | -1·09 | 1896 | -1 60 | - 47 | -1 74 | -1·04 |
| 1867 | .00 | - .58 | +1 47 | -1·66 | 1897 | - .71 | - .65 | - .21 | - .36 |
| 1868 | -1 52 | -1 70 | - 61 | +1 45 | 1898 | - 38 | - .72 | - 21 | - .47 |
| 1869 | - 30 | + .69 | - 18 | +2 05 | 1899 | +1 31 | - 11 | + .95 | -1·45 |
| 1870 | + 30 | + .90 | +1 07 | +1·06 | 1900 | +1 63 | +1·41 | +1 74 | -1·58 |
| 1871 | - 14 | + 79 | + 67 | - 36 | 1901 | - .38 | + 07 | + 55 | - .34 |
| 1872 | -1 09 | - .61 | + 31 | - 67 | 1902 | - 38 | + .47 | + 55 | + .08 |
| 1873 | 00 | - .36 | - 43 | -1 27 | 1903 | -1·17 | + 11 | + .55 | +1·40 |
| 1874 | + .63 | + 40 | -1 53 | -2 10 | 1904 | - .16 | +1·16 | +1·84 | - .39 |
| 1875 | +1 88 | +2·24 | + 67 | -1 04 | 1905 | - .79 | - 51 | .00 | + .73 |
| 1876 | - .49 | - .47 | + 31 | + 83 | 1906 | - .60 | -1 59 | + 89 | - .16 |
| 1877 | - .60 | -1 12 | 00 | - 91 | 1907 | 00 | + 79 | + 89 | + .03 |
| 1878 | + .52 | +1 30 | +1 01 | - 85 | 1908 | .00 | 00 | + .55 | +1·32 |
| 1879 | + 90 | - .14 | + 31 | +2·41 | 1909 | + 46 | - .47 | 00 | - .13 |
| 1880 | - 65 | +1·08 | -1·41 | +1·09 | 1910 | - .57 | - 94 | -1·71 | - .16 |
| 1881 | -1·41 | -2 49 | -1 41 | + 16 | 1911 | + .24 | + .90 | - 24 | - .16 |
| 1882 | - 95 | + .43 | - .46 | - 44 | 1912 | - .27 | - 90 | -1 47 | - .03 |
| 1883 | + .16 | - .40 | + 55 | -1 01 | 1913 | +1·11 | + 97 | -2 57 | - .31 |

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CHAPTER VI

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS

- A Indoor Pauperism (Average of 4 quarterly figures of number of paupers relieved indoors per 1,000 population)
 B Outdoor Pauperism (Average of 4 quarterly figures of number of paupers relieved in their own homes per 1,000 population).
 C Casual Pauperism (Average number of casual paupers relieved in casual wards of the metropolis on each Friday during the year).

| | A | B | C | | A | B | C |
|------|------|------|-----|------|------|------|------|
| 1857 | 6 26 | 37 6 | | 1886 | 6 55 | 20 0 | 578 |
| 1858 | 6 19 | 38 6 | | 1887 | 6 57 | 19 7 | 738 |
| 1859 | 5 65 | 35 8 | | 1888 | 6 58 | 19 4 | 1136 |
| 1860 | 5 53 | 34 4 | | 1889 | 6 42 | 18 6 | 960 |
| 1861 | 6 07 | 35 1 | | 1890 | 6 18 | 17 6 | 858 |
| 1862 | 6 44 | 39 8 | | 1891 | 6 04 | 16 9 | 842 |
| 1863 | 6 33 | 41 8 | | 1892 | 6 12 | 16 6 | 919 |
| 1864 | 6 06 | 37 9 | | 1893 | 6 35 | 16 8 | 957 |
| 1865 | 6 02 | 35 8 | | 1894 | 6 50 | 16 8 | 1086 |
| 1866 | 6 05 | 34 3 | | 1895 | 6 64 | 17 5 | 1129 |
| 1867 | 6 44 | 36 4 | | 1896 | 6 50 | 16 8 | 1063 |
| 1868 | 6 78 | 37 0 | | 1897 | 6 46 | 16 6 | 1045 |
| 1869 | 6 71 | 36 7 | | 1898 | 6 46 | 16 5 | 1064 |
| 1870 | 6 63 | 36 7 | | 1899 | 6 36 | 15 4 | 1009 |
| 1871 | 6 36 | 35 5 | | 1900 | 6 18 | 14 9 | 916 |
| 1872 | 5 97 | 31 1 | | 1901 | 6 31 | 14 8 | 969 |
| 1873 | 5 88 | 28 0 | | 1902 | 6 44 | 14 8 | 985 |
| 1874 | 5 77 | 25 7 | | 1903 | 6 67 | 14 9 | 1089 |
| 1875 | 5 61 | 24 1 | | 1904 | 7 05 | 15 6 | 1133 |
| 1876 | 5 65 | 21 8 | | 1905 | 7 26 | 15 8 | 1168 |
| 1877 | 5 94 | 21 0 | | 1906 | 7 24 | 15 5 | 1190 |
| 1878 | 6 18 | 21 0 | | 1907 | 7 25 | 15 0 | 1122 |
| 1879 | 6 58 | 22 6 | | 1908 | 7 56 | 15 2 | 1114 |
| 1880 | 6 76 | 21 8 | | 1909 | 7 70 | 15 1 | 1134 |
| 1881 | 6 83 | 21 5 | | 1910 | 7 71 | 14 4 | 1099 |
| 1882 | 6 68 | 20 5 | | 1911 | 7 39 | 10 7 | 992 |
| 1883 | 6 64 | 20 0 | 482 | 1912 | 7 33 | 11 0 | |
| 1884 | 6 60 | 19 4 | 510 | 1913 | 7 06 | 10 3 | |
| 1885 | 6 55 | 19 4 | 580 | | | | |

Source of data in Table A —

Annual Reports of the Local Government Board.

CHAPTER VI

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|---|
| A | 1857-1885 | 1871 | $y = 6.177 - .0125x + .00098x^2 + .000232x^3 + .0000002x^4$ |
| | 1883-1913 | 1898 | $y = 6.322 + .0657x + .01015x^2 - .000197x^3 + .000035x^4$ |
| B | 1857-1881 | 1869 | $y = 34.09 - 1.196x - .04637x^2 + .003913x^3$ |
| | 1879-1913 | 1896 | $y = 16.72 - .143x + .00089x^2 - .000702x^3$ |
| C | 1883-1911 | 1897 | $y = 1055.8 + 8.15x - 1.355x^2 + .0776x^3$ |

- A. Indoor Pauperism.
 B. Outdoor Pauperism
 C. Casual Pauperism

CHAPTER VI

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics,
expressed in terms of standard deviation.

A Outdoor Pauperism

B Indoor Pauperism

C Casual Pauperism

| Standard dev. | A | B | C | Standard dev. | A | B | C |
|------------------|--------|-------|-------|------------------|-------|--------|--------|
| | 4 33% | 6 45% | 10 5% | | 4 33% | 6 45% | 10 5% |
| 1857 | +1 36 | +1 16 | | 1886 | - 23 | + .85 | -1 64 |
| 1858 | + .69 | + 93 | | 1887 | - 02 | + 93 | - .30 |
| 1859 | -1 .59 | - 71 | | 1888 | + 18 | + 95 | +3 .72 |
| 1860 | -2 24 | -1 53 | | 1889 | - 16 | + 51 | +1 07 |
| 1861 | - .37 | -1 44 | | 1890 | - 79 | - 19 | - .52 |
| 1862 | + 90 | + 34 | | 1891 | -1 06 | - .62 | -1 01 |
| 1863 | + 44 | +1 21 | | 1892 | - 60 | - .62 | - .52 |
| 1864 | - 62 | - 22 | | 1893 | + 42 | - 39 | - .38 |
| 1865 | - 81 | - 87 | | 1894 | + 97 | - 22 | + .66 |
| 1866 | - .69 | -1 21 | | 1895 | +1 57 | + .56 | + .86 |
| 1867 | + 74 | + 05 | | 1896 | + 97 | + 11 | + .17 |
| 1868 | +2 08 | + 76 | | 1897 | + 69 | - .00 | - 09 |
| 1869 | +1 87 | +1 21 | | 1898 | + 51 | + 11 | - .00 |
| 1870 | +1 64 | +1 79 | | 1899 | - 14 | - 87 | - 52 |
| 1871 | + 72 | +1 97 | | 1900 | -1 06 | -1 16 | -1 37 |
| 1872 | - 79 | + 47 | | 1901 | -1 02 | -1 07 | - .92 |
| 1873 | -1 06 | - 43 | | 1902 | -1 02 | - 88 | - .77 |
| 1874 | -1 41 | - 98 | | 1903 | - 67 | - .59 | + .11 |
| 1875 | -2 08 | -1 21 | | 1904 | + 23 | + 31 | + .52 |
| 1876 | -1 94 | -1 88 | | 1905 | + 44 | + 81 | + .83 |
| 1877 | - 92 | -1 71 | | 1906 | - 02 | + 87 | +1 .03 |
| 1878 | - .14 | - 99 | | 1907 | - 35 | + 78 | + 40 |
| 1879 | +1 .18 | + 47 | | 1908 | + .37 | +1 .44 | + .27 |
| 1880 | +1 .64 | + 23 | | 1909 | + 65 | +1 85 | + .37 |
| 1881 | +1 64 | + 16 | | 1910 | + 65 | +1 69 | - .03 |
| 1882 | + 74 | - 22 | | 1911 | - 28 | -2 14 | -1 .06 |
| 1883 | + 23 | - .22 | + 39 | 1912 | - .05 | -1 .04 | |
| 1884 | - 09 | - .47 | - 71 | 1913 | - 44 | -1 .27 | |
| 1885 | - .23 | + .03 | - .73 | | | | |

CHAPTER VII

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS

- A Per Capita Consumption of Beer, U K
 B Per Capita Consumption of Spirits, U K
 C Prosecutions for Drunkenness per 100,000 population, England and Wales
 D. Death-rates from Alcoholism per 100,000 population, England and Wales.

| | Gallons | | C. | D | | Gallons | | C | D |
|------|---------|------|-----|-----|------|---------|------|-----|------|
| | A | B | | | | A | B | | |
| 1854 | | | | 4 7 | 1884 | 27 8 | 1 01 | 736 | 4 7 |
| 1855 | | | | 4 4 | 1885 | 27.1 | 96 | 673 | 4 9 |
| 1856 | 22.6 | 1 01 | | 3 6 | 1886 | 26 9 | 94 | 600 | 5.1 |
| 1857 | 22 6 | 1.03 | | 4 0 | 1887 | 27.3 | 93 | 585 | 5 2 |
| 1858 | 23 6 | .98 | | 3 7 | 1888 | 27 2 | 93 | 591 | 5 2 |
| 1859 | 24 8 | 1 01 | | 4 5 | 1889 | 28.9 | 96 | 613 | 5 5 |
| 1860 | 23 8 | .93 | | 3 9 | 1890 | 30 0 | 1 02 | 660 | 7 0 |
| 1861 | 24 3 | .86 | | 3 3 | 1891 | 30.2 | 1 04 | 644 | 7.1 |
| 1862 | 24 1 | 83 | | 3 5 | 1892 | 29.8 | 1 03 | 591 | 6.7 |
| 1863 | 25 4 | 85 | | 4 0 | 1893 | 29 6 | 98 | 568 | 7.3 |
| 1864 | 26 7 | 90 | | 5.1 | 1894 | 29 4 | 97 | 594 | 6 1 |
| 1865 | 29 8 | 94 | | 5 0 | 1895 | 29 6 | 1.00 | 556 | 6.7 |
| 1866 | 29.4 | 1.01 | | 4 4 | 1896 | 30.8 | 1.01 | 608 | 7.1 |
| 1867 | 28.1 | .99 | | 3 4 | 1897 | 31 3 | 1.02 | 620 | 7.7 |
| 1868 | 28 2 | 98 | | 3.6 | 1898 | 31.8 | 1.03 | 642 | 7 8 |
| 1869 | 29 1 | 98 | | 3 4 | 1899 | 32 5 | 1.09 | 672 | 9 0 |
| 1870 | 30 2 | 1.01 | | 2 9 | 1900 | 31 6 | 1 12 | 633 | 11.3 |
| 1871 | 29 3 | 1 06 | | 3.2 | 1901 | 30.8 | 1 09 | 645 | 9 6 |
| 1872 | 32 2 | 1 15 | | 3 1 | 1902 | 30.3 | 1.05 | 637 | 8 4 |
| 1873 | 33 5 | 1 23 | 781 | 3 3 | 1903 | 29.8 | .99 | 691 | 7 7 |
| 1874 | 34.0 | 1 27 | 783 | 4 4 | 1904 | 28 9 | .96 | 676 | 7 0 |
| 1875 | 33.3 | 1.29 | 848 | 4.8 | 1905 | 27 9 | | 645 | 6 5 |
| 1876 | 33 7 | 1 27 | 843 | 4 6 | 1906 | 28 2 | | 616 | 6.6 |
| 1877 | 32 3 | 1 22 | 810 | 4 6 | 1907 | 27 8 | | 605 | 6 3 |
| 1878 | 32 2 | 1 19 | 777 | 4 5 | 1908 | 26.9 | | 576 | 5.5 |
| 1879 | 28 0 | 1 11 | 703 | 3 7 | 1909 | 26.1 | | 515 | 4 7 |
| 1880 | 27.0 | 1 07 | 672 | 3 7 | 1910 | 26 3 | | 490 | 4 2 |
| 1881 | 27 8 | 1 06 | 670 | 4 7 | 1911 | 27 2 | | 514 | 4 5 |
| 1882 | 27.6 | 1 05 | 720 | 5 0 | 1912 | 26 8 | | 544 | 4 5 |
| 1883 | 27 3 | 1 04 | 724 | 4 8 | 1913 | | | 557 | 5 1 |

Sources of data in Table A —

A and B Statistical Abstract, U K

C Judicial Statistics, England and Wales, Pt I

D Annual Reports of the Registrar-General of England and Wales

CHAPTER VII

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|---|
| A | 1856-1882 | 1869 | $y = 30.36 + .671x - .03416x^2 - .003273x^3$ |
| | 1880-1912 | 1896 | $y = 30.32 + .105x - .01733x^2 - .000613x^3$ |
| B | 1856-1880 | 1868 | $y = 1.018 + .0374x + .000555x^2 - .0002584x^3$ |
| | 1878-1904 | 1891 | $y = .986 + .0101x + .00063x^2 - .0001042x^3$ |
| C | 1873-1893 | 1883 | $y = 687.4 - 16.58x + 203x^2 + .053x^3$ |
| | 1893-1913 | 1903 | $y = 633.7 - 8.52x - 913x^2 + .071x^3$ |
| D | 1854-1900 | 1877 | $y = 4.053 + .0638x + .00529x^2 + .0000965x^3$ |
| | 1899-1913 | 1906 | $y = 6.253 - .606x + .0254x^2 + .00504x^3$ |

- A. Per Capita Consumption of Beer, U K
 B. Per Capita Consumption of Spirits, U K
 C. Prosecutions for Drunkenness (rates), England and Wales.
 D. Death-rates from Alcoholism, England and Wales.

CHAPTER VII

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics, expressed in terms of standard deviation

- A Per Capita Consumption of Beer.
 B Per Capita Consumption of Spirits
 C Prosecutions for Drunkenness
 D Death-rates from Alcoholism.

| Standard dev | A | B | C | D | Standard dev. | A | B | C | D |
|--------------|-------|-------|-------|-------|---------------|-------|-------|-------|-------|
| 3 83% | 4.08% | 5 49% | 11 8% | | 3 83% | 4.08% | 5.49% | 11.8% | |
| 1854 | | | | +1 00 | 1884 | + .21 | + .78 | +1.78 | — .16 |
| 1855 | | | | + .44 | 1885 | — .73 | — .25 | + .49 | — .08 |
| 1856 | — .57 | —2.01 | | —1 13 | 1886 | —1 20 | — .49 | —1.16 | — .05 |
| 1857 | — .57 | + .27 | | — .25 | 1887 | —1.04 | — .74 | —1.22 | — .20 |
| 1858 | + .68 | + .51 | | — .89 | 1888 | —1 36 | —1 00 | — .75 | — .48 |
| 1859 | +1 49 | +2 40 | | + .94 | 1889 | — .10 | — .27 | + .20 | — .34 |
| 1860 | — .13 | +1.13 | | — .25 | 1890 | + .73 | +1.00 | +1.86 | +1.45 |
| 1861 | — .23 | — .29 | | —1.48 | 1891 | + .60 | +1.23 | +1.49 | +1.14 |
| 1862 | —1.04 | —1 13 | | —1.00 | 1892 | + .08 | + .74 | — .07 | + .23 |
| 1863 | — .39 | — .83 | | + .16 | 1893 | — .26 | — .71 | — .66 | + .60 |
| 1864 | + .05 | .00 | | +2 59 | 1894 | — .52 | —1.20 | .00 | —1 23 |
| 1865 | +2 38 | + .51 | | +2.42 | 1895 | — .52 | — .71 | —1.53 | — .89 |
| 1866 | +1 20 | +1.52 | | +1 18 | 1896 | + .47 | — .71 | — .46 | — .80 |
| 1867 | — .73 | + .27 | | — .99 | 1897 | + .78 | — .69 | — .51 | — .54 |
| 1868 | —1.35 | — .98 | | — .39 | 1898 | +1 07 | — .44 | — .09 | — .81 |
| 1869 | —1 15 | —1.84 | | — .97 | 1899 | +1 75 | + .93 | + .67 | — .04 |
| 1870 | — .65 | —1 84 | | —2.06 | 1900 | +1 04 | +1.64 | — .44 | +1.62 |
| 1871 | —1 83 | —1 52 | | —1 42 | 1901 | + .31 | + .93 | — .04 | + .31 |
| 1872 | + .16 | — .22 | | —1 67 | 1902 | + .08 | + .51 | — .13 | — .35 |
| 1873 | + .99 | + .78 | — .87 | —1 28 | 1903 | — .18 | — .69 | +1.66 | — .49 |
| 1874 | +1 23 | +1 23 | — .69 | +1 18 | 1904 | — .68 | — .98 | +1 24 | — .60 |
| 1875 | + .60 | +1.45 | + .95 | +1 83 | 1905 | —1 36 | | + .93 | — .47 |
| 1876 | +1 12 | +1 00 | +1.09 | +1 30 | 1906 | — .76 | | + .44 | + .49 |
| 1877 | + .29 | + .22 | + .64 | +1.17 | 1907 | — .76 | | + .49 | + .94 |
| 1878 | + .81 | .00 | + .20 | + .78 | 1908 | —1.04 | | — .02 | + .52 |
| 1879 | —2 06 | — .64 | —1 22 | —1 02 | 1909 | —1.20 | | —1.33 | — .19 |
| 1880 | —2.06 | — .44 | —1 61 | —1 18 | 1910 | — .39 | | —2 09 | — .67 |
| 1881 | + .40 | + .27 | —1 29 | + .60 | 1911 | +1 31 | | —1.00 | + .03 |
| 1882 | + .50 | + .71 | + .44 | + .89 | 1912 | +1 77 | | + .33 | — .21 |
| 1883 | — .10 | + .98 | + .95 | + .28 | 1913 | | | + .98 | + .43 |

CHAPTER VIII

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS

- A Prosecutions for "All Indictable Crimes" per 100,000 population, England and Wales
- B. Prosecutions for "Crimes Against Property Without Violence" per 100,000 population, England and Wales.
- C. Prosecutions for "Crimes Against Property With Violence" per 100,000 population, England and Wales
- D Prosecutions for "Malicious Injuries to Property" per 100,000 population, England and Wales
- E. Prosecutions for "Crimes of Violence against the Person" per 100,000 population, England and Wales.
- F Prosecutions for "Crimes against Morals" per 100,000 population, England and Wales.

| | A | B | C | D | E | F |
|------|-----|-----|------|------|-----|-----|
| 1857 | 280 | 249 | 11 7 | 1 03 | 8 4 | 2 2 |
| 1858 | 270 | 240 | 9 4 | 92 | 7 7 | 2 7 |
| 1859 | 255 | 228 | 7 9 | 96 | 7 2 | 2 5 |
| 1860 | 243 | 220 | 7 1 | 95 | 6 3 | 2 2 |
| 1861 | 299 | 271 | 9 8 | 1 12 | 7 3 | 2 3 |
| 1862 | 301 | 270 | 11 4 | 1 69 | 7 7 | 2 5 |
| 1863 | 298 | 265 | 10 7 | 2 41 | 8 9 | 3 3 |
| 1864 | 280 | 249 | 9 8 | 1 73 | 8 7 | 3 3 |
| 1865 | 283 | 254 | 9 4 | 1 37 | 8 4 | 3 3 |
| 1866 | 269 | 243 | 8 9 | 1 07 | 7 4 | 2 9 |
| 1867 | 275 | 249 | 8 9 | 96 | 7 1 | 2 5 |
| 1868 | 284 | 255 | 10 3 | 1 33 | 8 1 | 2 8 |
| 1869 | 276 | 248 | 9 7 | 1 39 | 7 1 | 3 0 |
| 1870 | 249 | 226 | 7 6 | 1 05 | 6 1 | 2 8 |
| 1871 | 233 | 211 | 6 6 | 84 | 6 1 | 2 8 |
| 1872 | 225 | 205 | 5 7 | 68 | 5 7 | 2 7 |
| 1873 | 230 | 210 | 5 3 | 69 | 5 6 | 2 4 |
| 1874 | 225 | 205 | 5 4 | 83 | 6 8 | 2 5 |
| 1875 | 208 | 187 | 5 2 | 73 | 7 8 | 2 9 |
| 1876 | 213 | 191 | 5 9 | 83 | 7 4 | 3 2 |
| 1877 | 218 | 198 | 6 0 | 73 | 6 8 | 2 9 |
| 1878 | 224 | 202 | 6 5 | 1 02 | 6 3 | 2 6 |
| 1879 | 217 | 195 | 7 7 | 78 | 5 5 | 2 5 |
| 1880 | 236 | 215 | 6 9 | 1 09 | 5 5 | 2 7 |
| 1881 | 233 | 211 | 6 5 | 93 | 5 9 | 2 8 |
| 1882 | 240 | 217 | 7 4 | 95 | 6 3 | 3 4 |
| 1883 | 228 | 207 | 6 8 | 1 13 | 5 3 | 3 1 |
| 1884 | 221 | 199 | 6 9 | 98 | 5 8 | 3 5 |
| 1885 | 207 | 186 | 6 2 | 1 09 | 5 1 | 3 9 |
| 1886 | 204 | 181 | 6 8 | 1 01 | 5 5 | 5 0 |
| 1887 | 202 | 181 | 6 5 | 1 01 | 5 1 | 4 3 |

TABLES

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TABLE A (*continued*)

| | A | B | C. | D. | E | F |
|------|-----|-----|------|------|-----|-----|
| 1888 | 208 | 186 | 7 7 | 93 | 5 3 | 4 2 |
| 1889 | 202 | 183 | 6 5 | 95 | 4 6 | 3 7 |
| 1890 | 191 | 172 | 5 8 | .99 | 4 8 | 4 1 |
| 1891 | 186 | 167 | 5 7 | 87 | 4 5 | 3 9 |
| 1892 | 198 | 178 | 7.1 | .99 | 4.1 | 4 0 |
| 1893 | 193 | 172 | 7 2 | 94 | 4 5 | 4.1 |
| 1894 | 187 | 167 | 7 3 | 80 | 4.5 | 3 9 |
| 1895 | 167 | 148 | 6 5 | .97 | 4 5 | 3.8 |
| 1896 | 165 | 146 | 6 1 | .93 | 4 5 | 3 8 |
| 1897 | 163 | 144 | 6 6 | 1 05 | 4.5 | 3 5 |
| 1898 | 167 | 147 | 7 0 | 1 01 | 4 3 | 3.6 |
| 1899 | 158 | 139 | 6 4 | 1 10 | 4 3 | 3 6 |
| 1900 | 166 | 148 | 6 7 | 1 02 | 3 8 | 3 2 |
| 1901 | 170 | 151 | 7 3 | 90 | 4 2 | 3 2 |
| 1902 | 173 | 152 | 8 6 | 89 | 4 2 | 3 1 |
| 1903 | 176 | 153 | 9 4 | 99 | 3 8 | 3 3 |
| 1904 | 178 | 156 | 9.5 | 1 29 | 3 4 | 3.0 |
| 1905 | 181 | 158 | 10 2 | 1 16 | 3 4 | 3 0 |
| 1906 | 172 | 150 | 9 9 | 1.22 | 3 6 | 3 2 |
| 1907 | 177 | 155 | 9 6 | 1 09 | 3 4 | 3 0 |
| 1908 | 194 | 170 | 11 6 | 1 43 | 3 6 | 3 1 |
| 1909 | 190 | 166 | 11 8 | 1 24 | 3 3 | 2 6 |
| 1910 | 185 | 161 | 11 6 | 1 26 | 3 3 | 2 7 |
| 1911 | 172 | 148 | 11 0 | 1 51 | 2.8 | 2 4 |
| 1912 | 186 | 161 | 11 2 | 1 48 | 3.1 | 2 8 |
| 1913 | 173 | 148 | 10.9 | 1 25 | 2 9 | 3 1 |

Source of data in Table A —

Judicial Statistics, England and Wales, Part I Criminal.

CHAPTER VIII

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|--|
| A | 1857-1879 | 1868 | $y = 264.8 - 6.76x - 2332x^2 + .041x^3$ |
| | 1879-1913 | 1896 | $y = 177.6 - 1.87x + .1262x^2 + .001366x^3$ |
| B | 1857-1879 | 1868 | $y = 239.04 - 5.94x - .214x^2 + .0354x^3$ |
| | 1883-1913 | 1898 | $y = 153.45 - 813x + .1304x^2 - .00345x^3$ |
| C | 1857-1881 | 1869 | $y = 7.92 - 4097x + .00176x^2 + .00229x^3$ |
| | 1879-1913 | 1896 | $y = 7.01 + .185x + .0099x^2 - .000203x^3$ |
| D | 1857-1879 | 1868 | $y = 1.232 - .095x - .003187x^2 + .000869x^3$ |
| | 1879-1913 | 1896 | $y = .977 + .0063x + .000854x^2 + .000029x^3$ |
| E | 1857-1879 | 1868 | $y = 7.257 - .125x - .00247x^2 + .000574x^3$ |
| | 1879-1913 | 1896 | $y = 4.366 - .089x + .000123x^2 - .0000208x^3$ |
| F | 1857-1885 | 1871 | $y = 2.776 - .0376x + .00079x^2 + .000495x^3$ |
| | 1889-1913 | 1902 | $y = 3.324 - .0925x + .00043x^2 + .000347x^3$ |

- A Prosecutions for All Indictable Crimes
 B Prosecutions for Crimes against Property without Violence.
 C Prosecutions for Crimes against Property with Violence.
 D. Prosecutions for Malicious Injuries to Property
 E Prosecutions for Crimes of Violence against the Person.
 F Prosecutions for Crimes against Morals.

CHAPTER VIII

TABLE C

CYCLES

Percentage Deviations of Annual Items from Secular Trend for Series of Social Statistics, expressed in Terms of Standard Deviation.

- A Prosecutions for All Indictable Crimes.
 B Prosecutions for Crimes against Property without Violence.
 C Prosecutions for Crimes against Property with Violence.
 D Prosecutions for Malicious Injuries to Property.
 E Prosecutions for Crimes of Violence against the Person.
 F Prosecutions for Crimes against Morals

| Standard dev. | A | B | C | D | E | F |
|---------------|-------|-------|-------|-------|-------|-------|
| | 5 00% | 4 88% | 11 7% | 15.5% | 8 38% | 8 07% |
| 1857 | +1.84 | +1.60 | +2.47 | +2.64 | +1.31 | .00 |
| 1858 | + .18 | - .10 | - .17 | - .45 | + .02 | +2.10 |
| 1859 | -1.61 | -1.74 | -1.73 | -1.30 | - .88 | + .04 |
| 1860 | -2.83 | -2.83 | -2.55 | -1.88 | -2.32 | -2.03 |
| 1861 | + .84 | +1.05 | - .26 | -1.43 | - .76 | -1.98 |
| 1862 | + .94 | + .86 | +1.16 | + .83 | - .12 | -1.41 |
| 1863 | + .68 | + .45 | + .60 | +3.77 | +1.78 | +1.83 |
| 1864 | - .42 | - .62 | + .09 | + .95 | +1.58 | +1.66 |
| 1865 | + .04 | .00 | .00 | - .44 | +1.25 | +1.62 |
| 1866 | - .60 | - .57 | - .19 | -1.52 | - .13 | - .07 |
| 1867 | + .30 | + .35 | + .19 | -1.75 | - .45 | -1.75 |
| 1868 | +1.42 | +1.39 | +2.09 | + .53 | +1.27 | - .35 |
| 1869 | +1.40 | +1.35 | +1.98 | +1.42 | - .06 | + .64 |
| 1870 | - .16 | - .10 | + .13 | + .06 | -1.54 | - .10 |
| 1871 | - .90 | - .82 | - .61 | - .70 | -1.36 | + .10 |
| 1872 | -1.04 | - .88 | -1.39 | -1.35 | -1.86 | - .19 |
| 1873 | .00 | + .23 | -1.59 | - .81 | -1.86 | -1.41 |
| 1874 | .00 | + .23 | -1.11 | + .78 | + .48 | - .84 |
| 1875 | -1.10 | -1.23 | -1.14 | + .19 | +2.50 | +1.08 |
| 1876 | - .38 | - .51 | .00 | + .45 | +1.91 | +2.47 |
| 1877 | + .26 | + .43 | + .15 | - .17 | + .85 | + .97 |
| 1878 | + .82 | + .82 | + .70 | +1.48 | - .05 | - .57 |
| 1879 | .00 | .00 | +1.90 | -1.26 | -1.31 | -1.25 |
| 1880 | * | * | + .26 | + .72 | - .84 | - .69 |
| 1881 | * | * | - .51 | - .34 | + .23 | - .69 |
| 1882 | * | * | + .62 | - .19 | +1.30 | +1.12 |
| 1883 | + .74 | .00 | + .14 | + .99 | - .60 | - .72 |
| 1884 | + .46 | + .10 | + .40 | + .06 | + .69 | - .04 |
| 1885 | - .50 | - .84 | - .27 | + .80 | - .64 | + .47 |
| 1886 | - .40 | - .70 | + .53 | + .27 | + .48 | † |
| 1887 | - .18 | - .23 | + .27 | + .27 | - .19 | † |
| 1888 | + .80 | + .96 | +1.90 | - .26 | + .47 | +1.14 |

* Omitted because of effects of Summary Jurisdiction Act of 1879.

† Omitted because of effects of Criminal Law Amendment Act of 1885.

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TABLE C (continued)

| Standard dev. | A | B | C | D | E | F |
|------------------|-------|-------|-------|-------|-------|-------|
| | 5.00% | 4.88% | 11.7% | 15.5% | 8.38% | 8.07% |
| 1889 | + .62 | +1.05 | + .27 | - .07 | - .96 | - .62 |
| 1890 | - .22 | + .25 | - .68 | + .20 | - .26 | + .52 |
| 1891 | - .42 | .00 | - .94 | - .61 | - .80 | - .15 |
| 1892 | +1.20 | +1.78 | + .94 | + .20 | -1.60 | + .20 |
| 1893 | +1.00 | +1.39 | + .77 | - .14 | - .35 | + .57 |
| 1894 | +1.00 | +1.03 | + .77 | -1.13 | - .11 | + .11 |
| 1895 | -1.47 | -1.15 | - .38 | .00 | + .11 | - .06 |
| 1896 | -1.49 | -1.31 | -1.11 | - .33 | + .36 | + .14 |
| 1897 | -1.49 | -1.35 | - .70 | + .46 | + .61 | - .62 |
| 1898 | - .80 | - .82 | - .46 | + .13 | + .33 | .00 |
| 1899 | -1.73 | -1.89 | -1.46 | + .64 | + .57 | + .32 |
| 1900 | - .70 | - .53 | -1.30 | .00 | - .64 | - .81 |
| 1901 | - .22 | - .17 | - .95 | - .81 | + .84 | - .07 |
| 1902 | + .22 | .00 | + .21 | - .99 | +1.12 | - .51 |
| 1903 | + .60 | + .17 | + .69 | - .48 | + .13 | + .62 |
| 1904 | + .82 | + .41 | + .50 | +1.12 | - .87 | - .25 |
| 1905 | +1.04 | + .66 | + .83 | + .24 | - .63 | + .07 |
| 1906 | - .14 | - .53 | + .18 | + .39 | + .31 | +1.19 |
| 1907 | + .38 | + .14 | - .34 | - .55 | - .11 | + .61 |
| 1908 | +2.05 | +1.99 | +1.09 | +1.04 | + .88 | +1.28 |
| 1909 | +1.34 | +1.33 | + .96 | - .14 | + .08 | - .84 |
| 1910 | + .56 | + .68 | + .46 | - .24 | + .37 | - .37 |
| 1911 | -1.20 | -1.19 | - .22 | + .71 | -1.27 | -1.73 |
| 1912 | .00 | + .37 | - .38 | + .32 | + .16 | - .09 |
| 1913 | -1.71 | -1.44 | - .79 | - .95 | - .36 | + .97 |

CHAPTER IX

TABLE A

ORIGINAL ITEMS OF SERIES OF SOCIAL STATISTICS

A Total number of emigrants of British Origin leaving U K.

B. Total number of emigrants of British Origin leaving U K. for U S A

| | A | B | | A | B. |
|------|-----------|-----|------|-----------|-----|
| | Thousands | | | Thousands | |
| 1862 | 98 | | 1888 | 280 | 196 |
| 1863 | 193 | | 1889 | 254 | 169 |
| 1864 | 187 | | 1890 | 218 | 152 |
| 1865 | 175 | | 1891 | 219 | 156 |
| 1866 | 170 | | 1892 | 210 | 150 |
| 1867 | 157 | | 1893 | 209 | 149 |
| 1868 | 138 | | 1894 | 156 | 104 |
| 1869 | 186 | | 1895 | 185 | 126 |
| 1870 | 203 | 153 | 1896 | 162 | 99 |
| 1871 | 193 | 151 | 1897 | 146 | 85 |
| 1872 | 210 | 162 | 1898 | 141 | 80 |
| 1873 | 228 | 167 | 1899 | 146 | 92 |
| 1874 | 197 | 114 | 1900 | 169 | 103 |
| 1875 | 141 | 81 | 1901 | 172 | 104 |
| 1876 | 109 | 55 | 1902 | 206 | 108 |
| 1877 | 95 | 45 | 1903 | 260 | 124 |
| 1878 | 113 | 55 | 1904 | 271 | 146 |
| 1879 | 164 | 92 | 1905 | 262 | 122 |
| 1880 | 228 | 167 | 1906 | 325 | 145 |
| 1881 | 243 | 176 | 1907 | 396 | 170 |
| 1882 | 279 | 182 | 1908 | 263 | 97 |
| 1883 | 320 | 192 | 1909 | 289 | 110 |
| 1884 | 242 | 155 | 1910 | 398 | 132 |
| 1885 | 208 | 138 | 1911 | 455 | 122 |
| 1886 | 233 | 153 | 1912 | 468 | 117 |
| 1887 | 281 | 202 | 1913 | 470 | 129 |

Source of data in Table A Statistical Abstract, U K

CHAPTER IX

TABLE B

FORMULÆ FOR LINES OF SECULAR TREND FOR SERIES OF SOCIAL STATISTICS

| Series | Period | Origin | Formula |
|--------|-----------|--------|---|
| A | 1862-1890 | 1876 | $y = 187.72 + 4.324x + .1472x^2 - .003102x^3$ |
| | 1889-1913 | 1901 | $y = 194.00 + 12.95x + 1.231x^2 - .02353x^3$ |
| B | 1870-1890 | 1880 | $y = 123.2 + 12.29x + .481x^2 - .14x^3$ |
| | 1889-1913 | 1901 | $y = 109.2 + 3.272x + .278x^2 - .04178x^3$ |

A Total Emigrants of British Origin from U K

B Total Emigrants of British Origin leaving U K for U S A

CHAPTER IX

TABLE C

CYCLES

Percentage deviations of annual items from secular trend for series of social statistics, expressed in terms of standard deviation.

A Total Emigrants of British Origin from U K

B Emigrants of British Origin leaving U K for U S A

| Standard dev | A | B | Standard dev. | A | B |
|-----------------|-------|-------|------------------|-------|-------|
| | 19 1% | 21 3% | | 19·1% | 21·3% |
| 1862 | -2 12 | | 1888 | + 62 | + ·38 |
| 1863 | + 97 | | 1889 | + ·16 | - ·08 |
| 1864 | + 80 | | 1890 | - 32 | - ·23 |
| 1865 | + 42 | | 1891 | + 20 | + ·32 |
| 1866 | + 26 | | 1892 | + 42 | + ·61 |
| 1867 | - 19 | | 1893 | + 82 | +1·04 |
| 1868 | - 83 | | 1894 | - ·49 | - ·40 |
| 1869 | + 63 | | 1895 | + 60 | + ·74 |
| 1870 | +1 09 | - ·87 | 1896 | - 03 | - ·26 |
| 1871 | + ·71 | - 10 | 1897 | - 55 | - ·82 |
| 1872 | +1 13 | +1 30 | 1898 | - 83 | -1·04 |
| 1873 | +1 67 | +2 50 | 1899 | - 81 | - ·54 |
| 1874 | + 50 | + ·81 | 1900 | - 37 | - ·14 |
| 1875 | -1 24 | - ·52 | 1901 | - 60 | - ·22 |
| 1876 | -2 19 | -1 86 | 1902 | - ·05 | - ·21 |
| 1877 | -2 64 | -2 44 | 1903 | + 81 | + ·28 |
| 1878 | -2 23 | -2 16 | 1904 | + 61 | +1·02 |
| 1879 | - 98 | - 83 | 1905 | - 04 | - ·08 |
| 1880 | + 53 | +1 68 | 1906 | + 69 | + ·67 |
| 1881 | + 73 | +1 37 | 1907 | +1·44 | +1·45 |
| 1882 | +1 46 | +1·04 | 1908 | -1 15 | -1·21 |
| 1883 | +2 24 | + 90 | 1909 | -1 08 | - ·78 |
| 1884 | + 27 | - 44 | 1910 | + 07 | + ·04 |
| 1885 | - 62 | -1 08 | 1911 | + 40 | - ·22 |
| 1886 | - ·21 | - ·78 | 1912 | + ·16 | - ·23 |
| 1887 | + 67 | + 43 | 1913 | - ·18 | + ·53 |

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